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"PAUL PRY" *learns*

1940 MODELS TURN TO BORGLITE DRIVEN PLATE FOR SHIFTING EASE . . .

● It clicked in the '39 cars—it's much more popular in those 1940 models that have joined the industry-wide swing to steering-post gear shifts. An increased demand for the new driven plate that helped make the new style shifting so easy and practical is a most logical deduction, says Paul Pry, the industry's improvement detective—and he's right! Try it and see.

THE BORG & BECK CLUTCH *with* BORGLITE DRIVEN PLATE

1. Cover plate better ventilated, designed for life-long even contact with the plate.
2. New, lighter Borglite driven plate for "finger touch" gear shifting.
3. Waved "clock-spring" steel cushion segments, tailor made to bring facings into full contact.
4. Light weight at outside edge cuts spinning time, results in faster, easier and quieter gear changing.

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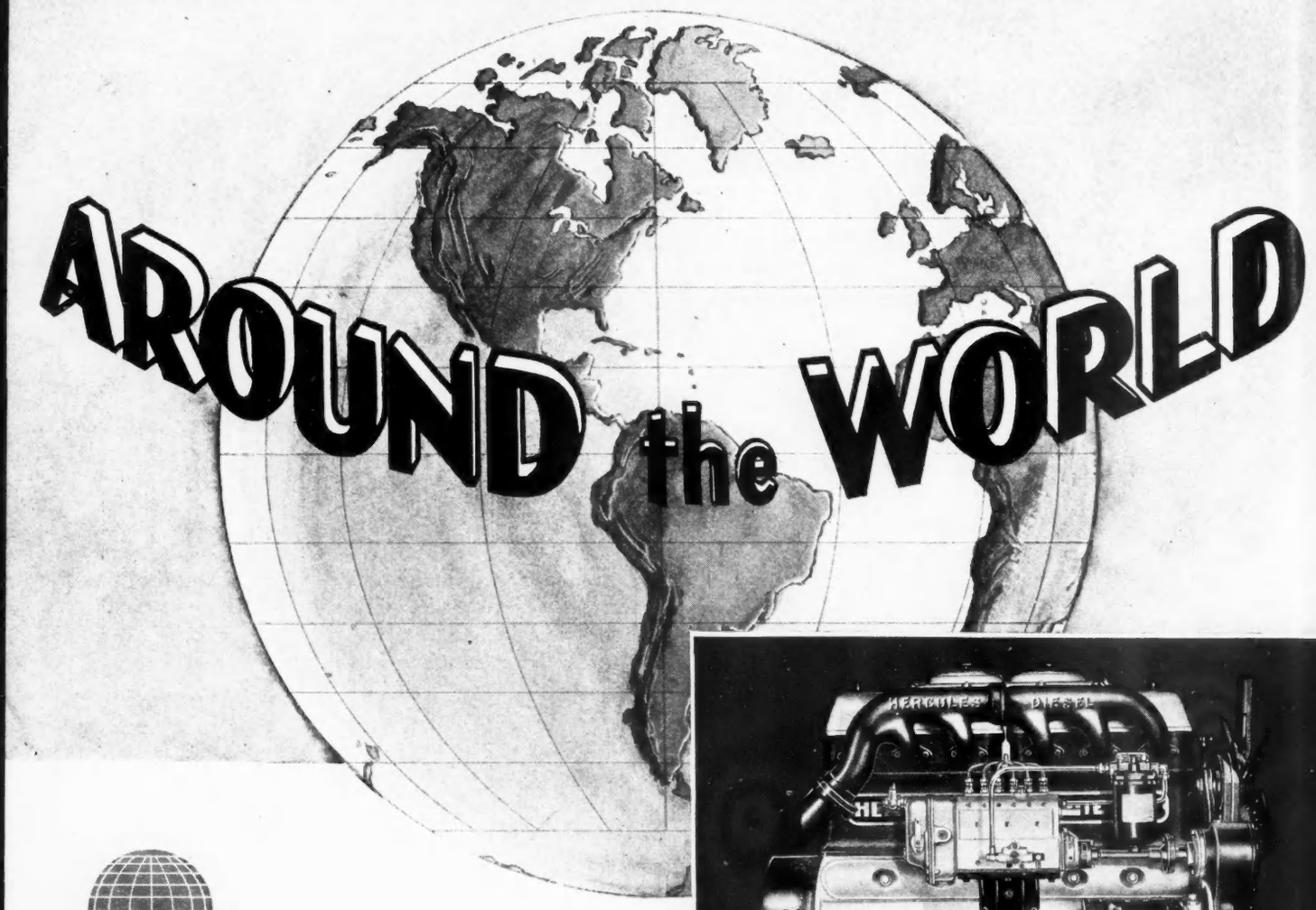
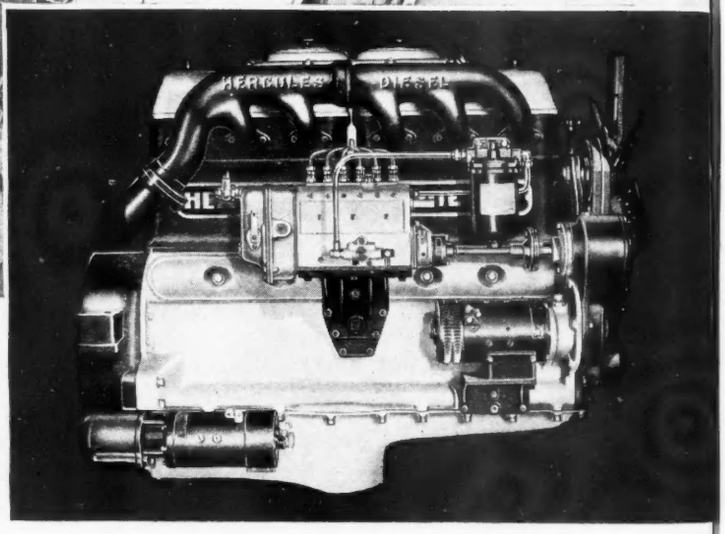




HERCULES Engines are, in the broadest meaning of the term, "used throughout the world." The traditional simplicity of design and precision manufacture characteristic of Hercules Engines from the beginning, have played an important part in making Hercules Motors Corporation the world's largest manufacturer specializing in the design and construction of Gasoline and Diesel Engines, exclusively. And all over the globe the name Hercules carries full assurance of utmost dependability.

Keeping pace with the steadily growing demands of world industry, Hercules makes available to truck, bus, tractor and other users of automotive type engines—as well as power users in the agricultural, industrial, marine and oil fields—new models of Gasoline and Diesel Engines and Power Units fully representative of the best in today's engineering practice. This is particularly true in the rapidly-growing Diesel field. Fourteen models of Hercules Diesels are now available—in smooth-running, clean-burning, quickly responsive two-cylinder, four-cylinder and six-cylinder engines.

Full information regarding the complete Hercules line of Gasoline and Diesel engines for heavy-duty service will be mailed on request.

HERCULES MOTORS CORPORATION, Canton, Ohio, U. S. A.

HERCULES ENGINES

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

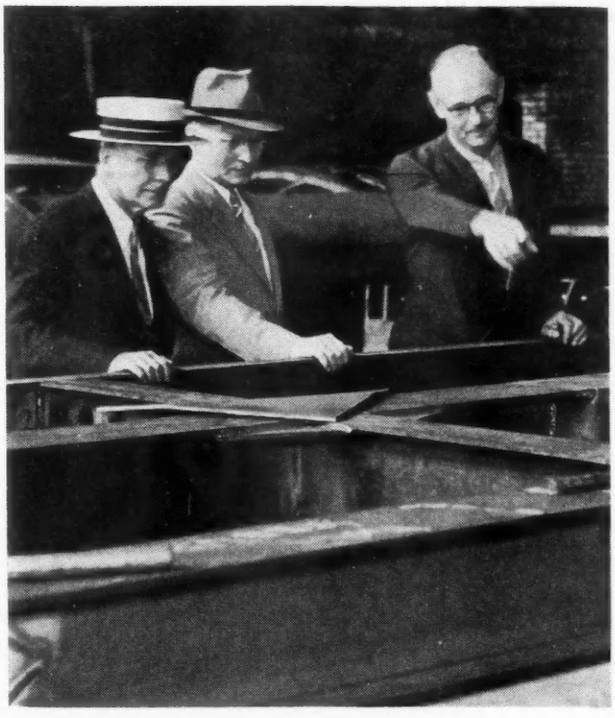
Vol. 81, No. 8
October 15, 1939

De Re Metallica: 1939

Metal Show and Metal Congress

Provide A Vast Crucible for Reducing Production Problems

CANCELLATION of the Machine Tool Show and Congress planned for this year leaves undisputed the claims of the National Metal Show and the National Metals Congress as the outstanding events of interest to everyone whose livelihood depends in any way on the Vulcanic trades. Designed as a colossal reply to the query "what's new in metals" the Show and Congress will convene in Chicago Oct. 23 and continue through Oct. 27.



Plant visits will be an outstanding feature of the National Metal Congress. Eugene A. Balsley, chairman of the Chicago Section A.W.S., H. C. Boardman, national president, and Ernest Kuehn, works manager of the Electro-Motive Corporation's plant at La Grange, Ill., go over the Electro-Motive itinerary in advance.

The American Society for Metals, the American Institute of Mining and Metallurgical Engineers, the American Welding Society and The Wire Association have prepared technical programs for the Congress which, while exploring the farthest horizons of metallurgy, establish a close link between the laboratory and current practice through a profusion of papers on technical applications, and a number of plant visits.

The war in Europe and the imminence of the Metal Show have combined to focus attention on a number of announcements in the metallurgical field. The Ekko process for the electrodeposition of iron to form molds and dies; the availability of aluminum alloy bearing materials; the commercialization of a lustrous black-plating process; are all striking advances which will find their niche in the automotive industry.

Gaps between perfectioning of a process and its application in production are being closed on many fronts. The Metal Show will include, for example, the first public demonstration of the furnace brazing of aluminum, the latest developments in special-atmosphere equipment for copper brazing, a new high-speed production brazing setup, a liquid carburizing bath which features faster penetration of carbon at short heat for production runs of small parts.

Production men will probably be interested also in the strip steel in which color is introduced before forming, in new welding electrodes, and in new universal offset and ejector types of water-cooled holders for spot welding tips.

Examination of the exhibit schedules indicates intense activity in the field of controlled atmosphere heat processing. But the field of instrumentation for quality control and the list of new alloys, both ferrous and non-ferrous are also impressive.

In all departments the Metal Show will be distinguished by the number of working exhibits, and in many cases exhibitors invite the submission of samples for processing on the floor of the Show.

More than 150 technical papers and lectures will be given during the five days of the National Metal Con-

gress, held concurrently with the Metal Show. The American Society for Metals and the American Welding Society have scheduled the fattest programs of the Congress, but the American Institute of Mining and Metallurgical Engineers and the Wire Association offer more than 30 papers between them. There isn't space here to list the complete program, but we have selected for mention some of the papers.

On the A.S.M. program E. J. Janitzky and M. Baeyertz of Carnegie-Illinois Steel will discuss the "Interrelation Between Stress and Strain in the Tensile Test." G. L. Kehl of U. S. Steel and C. M. Offenhauer of Lehigh University will give a paper on the "Fatigue Resistance of Steel as Affected by Acid Pickling." An analysis of "Machinability Data From Cold Finished and Heat Treated S.A.E. 1045 Steel" will be presented by O. W. Boston and W. W. Gilbert of the University of Michigan. F. J. Robbins and G. R. Caskey of Bliss and Laughlin will discuss "Lead Bearing Steel." The "Drawing of Aluminum" will be the subject of L. J. Weber and J. T. Weinzierl of the Aluminum Cooking Utensil Co.

Also on the A.S.M. program will be a paper on the "Selection of Steel and Heat Treatment for Spur Gears" by H. B. Knowlton and E. H. Snyder of the International Harvester Co. "A Hardenability Test for Shallow Hardening Steels" will be presented by W. E. Jominy of General Motors, while "Hardness Characteristics of Some Medium Carbon S.A.E. Steels" will be given by P. Klain and C. H. Lorig of the Battelle Memorial Institute.

Turning to the A.I.M.E. portion of the program. "A Laboratory Study of the Reactions Occurring Between Molten Zinc Alloys and Pressure Die Casting Equipment" will be presented by E. A. Anderson, Gerald Edmunds and C. W. Siller of the New Jersey Zinc Co. Alan U. Seybolt and B. W. Gonser of Battelle will describe a "High Strength Silicon Brass Die Casting Alloy." "The Beneficial Effects of Zirconium in Cast Nickel-Silicon Bronzes" is authored by F. R. Hensel, E. I. Larsen and A. S. Doty, P. R. Mallory & Co.

Nearly all of the American Welding Society Sessions are packed with material of interest to the automotive designer and production man. H. J. Franch and T. N. Armstrong of International Nickel lead off the automotive portion of the program with "Some Aspects of the Welding of Alloy Steels," followed by "An Investigation of the Spot Welding of Automobile Grade Mild Steel" (W. F. Hess and R. A. Wyant, Rensselaer Polytechnic Institute) and "The Failure of Aluminum Subjected to Combined Stresses" by Joseph Marin of Rutgers University.

Under the head of production welding in light gage material G. C. Gridley, Mechanics Universal Joint Division, Borg-Warner Corp., will speak on "Welding Tubing for the Automotive Industry." "Machine Welded Sheet Metal Parts for Enameling" will be the subject of Joseph C. Lewis, Associated Engineers, Inc.

At the meeting devoted to fundamental research in welding, G. E. Doan of Lehigh University will discuss "Arc Welding in Controlled Atmospheres."

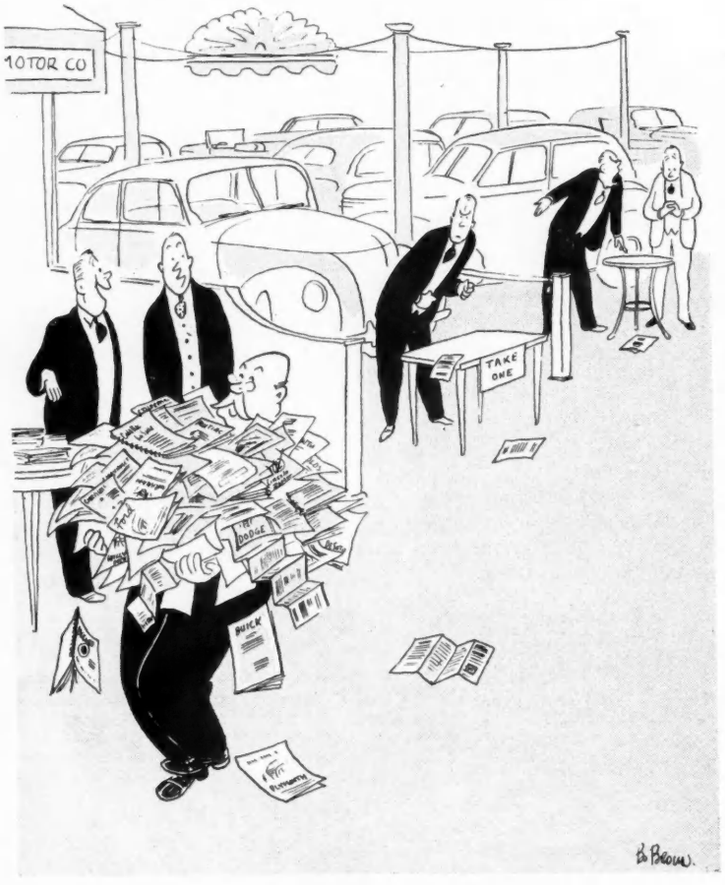
The session of machinery construction includes a paper on "Flow of Materials in Production Welding" by W. W. Petry, Cincinnati Milling Machine Co., and one on "Welding Heavy Presses" by L. J. McDonough and J. R. Henry of the Clearing Machine Corp.

Welding in equipment construction will be the subject of a session which includes a paper on "Fabrication of Road Building Equipment" by L. L. Burger, La Plant-Choate Mfg. Co., one on "Designing Construction Machinery for Production by Welding" by H. C. Hettelsater, Harnischfeger Corp., and one on "Cutting and Welding Stainless Clad Steel" by W. B. Keelor, of the Farwell Metal Fabricating Division of Farwell, Ozmun, Kirk and Co.

An entire session will be given to four papers on flame hardening and hard surfacing presented by Fred C. Dull, Monarch Machine Tool Co.; T. B. Jefferson of the Marine Design Section of the War Department, J. H. Zimmerman of the Linde Air Products Co. and W. G. Hamilton of the Accurate Steel Treating Co. Six papers spread over two sessions will be devoted to various

(*Turn to page* 466)

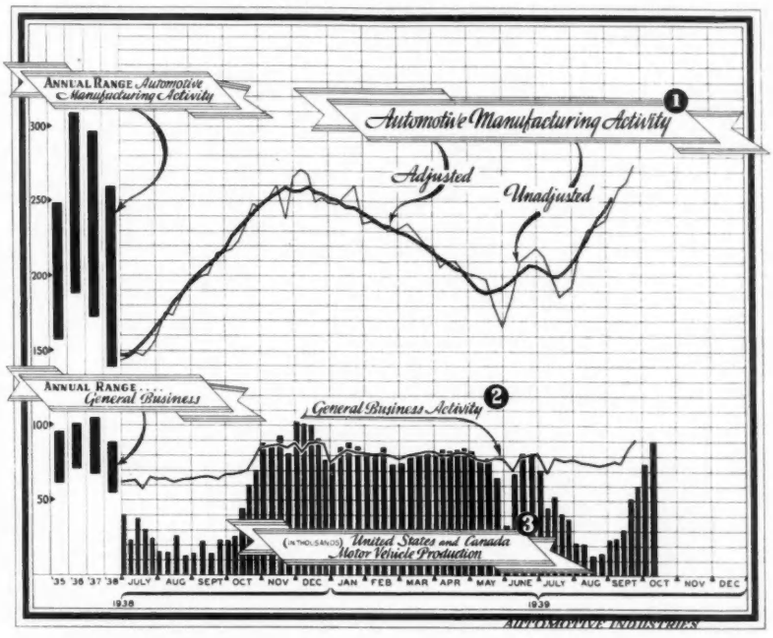
The Brass-Hat Rack



"He claims he's outsmarting our competitors . . . And what can they do about it!"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

Sharp Rise in Production

PRODUCTION of cars and trucks for the first two weeks in October rose sharply over the rate maintained in September as Ford and Chevrolet plants added their important contributions. Every indication to even higher weekly rates for the remaining half of the month and it is expected that early in November the industry will reach top figures and maintain them at least through the balance of the current year.

Although Ford and Chevrolet were just getting under way on final assemblies during the early part of October, their contributions to the total, added to increasing schedules by practically all other manufacturers, brought output for the week ending Oct. 7 to an estimated 75,000 units.[3] Based on preliminary estimates it was expected that production for the second week in the month would be somewhere near the 90,000 mark and it appears that car and truck production will exceed 100,000 units weekly before the end of the month is reached.

Opening of the National Automobile Show on Oct. 15 was expected to find most dealers stocked with representative displays of 1940 models and in excellent position to begin the new model year. Manufacturers in many instances report almost complete sell outs of 1939 models with stocks on hand averaging less than one per dealer nationally. Combined with this is a healthy used car situation with stocks of used cars in dealers' hands lower than in several years.

Industry leaders are estimating that production for the 1939 calendar year will probably reach 3,700,000 or 3,800,000 cars and trucks, a figure which is two or three hundred thousand units higher than estimates made at the beginning of the year. There has been an inclination, however, to refrain from issuing estimates beyond the end of the current year because of uncertainties presented by the labor situation and the war in Europe.

Since beginning work on 1940 models there already have been numerous delays and stoppages resulting from labor difficulties although the industry was hopeful that these disturbances would not become widespread. Nash, for example, could produce no cars during the first week in October because of a strike in its plants, while earlier in the new model season, Packard, Nash and Studebaker suffered interruptions in their schedules because of strikes in plants of suppliers.

Concurrent with the announcements of its 1940 models, Ford Motor Co. indicated that it expects to produce more than a quarter-million cars and trucks during the last three months of this year, while Chevrolet's schedule is predicated on an output of 260,000 cars and trucks in the remaining three months of 1939.

AUTOMOTIVE MANUFACTURING ACTIVITY advanced to higher levels in the weeks ended Sept. 23 and Sept. 30, carrying the unadjusted index curve through the points 263 and 174, respectively. The adjusted curve has gained altitude at a steady rate and stands at 253 for the week ended Sept. 9, having passed through 245 in the week ended Sept. 2.

GENERAL BUSINESS ACTIVITY: The summary, prepared for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co., which is usually found on this page appears in this issue on page 460.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp., New York. 1926 = 100; [3] Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES.

Cutting Fluids....

Indications are that there is very little trend of standardization but there is a definite tendency to a reduction in the variety for general use

By JOSEPH GESCHELIN

DESPITE the vital role of cutting fluids in all manner of metal cutting and metal finishing operations, despite the fact that millions of gallons of various proprietary materials of this type are consumed in automotive production annually, the practical aspects of the utilization of cutting fluids remain obscure, the subject receives but little serious attention by the management.

Spurred to action by these facts, an Independent Research Committee on Cutting Fluids was formed about two and a half years ago, enlisting the cooperation of a large group of technical people concerned with this aspect of machine shop practice. Its objective from the start has been to treat the subject realistically, to initiate practical studies, and to publish authentic reports of value to production men and users at large. Some appreciation of what has been done to date may be gained from a high-spotting of the studies already completed, several of which have been published.

Those concerned with the operation of machine shops must needs recognize several important facts with respect to cutting fluids. First is the need for a better appreciation of the most economic utilization of such materials. In the opinion of many well-informed people, this qualification can be met only by delegating responsibility, generally with the plant chemist or someone in the master mechanic's department. This is just as necessary with cutting fluids as it is with cutting tools or fixtures.

Having placed the responsibility in capable hands, the stage is set for the most constructive move—the SIMPLIFICATION of the types of cutting fluids required for any given plant, and the consequent standardization of the few essential materials that can cover its full requirements. The market abounds in all manner of proprietary products, chemically simple or exceedingly complex. Doubtless each one has its own particular place in metal cutting. But for any given machine shop it should be feasible to select the very minimum of types and grades, in keeping with the present day trend of standardization.

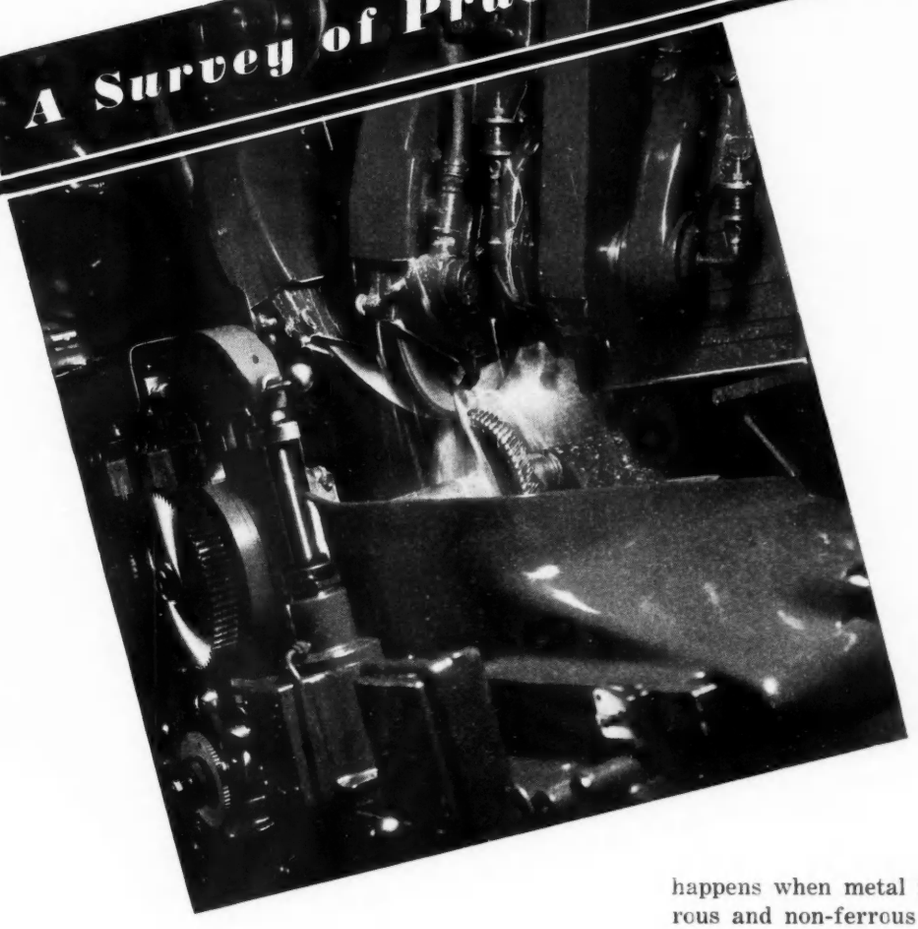
This principle is not merely a figment of the imagination. It has been applied successfully in some of the largest plants in the automotive industry. We can point to a number of establishments in which a single grade of soluble oil is handled in a centralized department, serving a mixture of medium strength to a majority of metal-cutting operations, and a weak mixture to grinding machines. The soluble oil is received, stored, filtered, mixed, and circulated by pipe lines to the machine shops, thus completely standardizing the procedure.

In much the same fashion, it is possible to organize the distribution of cutting oils and other blended products possessing E-P characteristics which may be indicated for various heavy-duty cutting operations and similar special functions. As a matter of fact, this procedure has been followed, we are told, in a number of large metal cutting establishments.

Excellent example of what may be accomplished with a realistic approach to this problem is found at Spicer Mfg. Co., whose operation is quite analogous to that of many parts plants. Here is a report from Spicer's master mechanic, R. B. Haynes:

> "We are pretty well standardized on one soluble oil and one cutting oil. The soluble is distributed from a central mixing plant by pipes to all departments at a water to soluble ratio of 20:1. It is thinned to suit the job at the point of application and such thinning varies from 30:1 for hobbing machines to 80:1 at grinding operations.
>
> "We use soluble indiscriminately for the majority

A Survey of Practice



of our jobs ranging from drilling and milling through hobbing and broaching.

"Our cutting oil is a sulfurized mineral oil we have developed for the purpose of covering the greatest variety of operations requiring oil. We use it where material does not respond to soluble coolant or where we suspect soluble may be detrimental to the machine.

"Aside from these two coolants we have a few special applications such as our Gleasons where a heavier sulfurization seems advisable. These spots probably account for less than 5 per cent of total coolant consumption."

We are cautioned by a practical authority on the subject that special provisions ofttimes are desirable where the soluble oil is used in grinding operations demanding a surface finish of exceptional quality. When the soluble oil is taken from a common tank both for general metal cutting and for grinding, and where fine grinding finish is essential, there are cases on record indicating the need for special baffling of the reservoir tank as well as the introduction of good filters.

It may even be good practice, where feasible, to use a separate tank and a different type of soluble oil to assure the quality of fine grinding jobs, particularly with provision for adequate filtering of the fluid to promote longer grinding wheel life.

Obviously, this is but one example of the variations from common practice that may be encountered in the search for improved techniques.

Cutting fluids, like other highly technical products, have many aspects which should be left to the technicians. It may surprise our readers to find that these simple materials are intimately related to such scientific research as the theory of metal cutting, what happens when metal is cut, the machinability of ferrous and non-ferrous metals. For our purpose, it is sufficient merely to consider the selection and application of the minimum number of cutting fluids for a given plant, resting many aspects of the scientific problem with the integrity of a reputable source of supply.

Judging by the evidence, it is safe to say that many of the current advances in machine shop practice such as finer surface finishes, closer tolerances, and improvements in productivity have been due, at least in part, to the availability of the modern cutting fluids. Indeed, the cutting fluid is so intimately related to the metal-cutting operation that it is as much a part of the set-up as are the tools and fixtures. Perhaps it is this bond of intimacy that has clouded the issue and prevented a full realization of the practical role of cutting fluids.

First of all, what is a cutting fluid? Cutting fluids, commonly referred to as lubricants or coolants, consist of those liquids which are applied to the materials being cut and to the tool or tools to facilitate the cutting operation. The mechanism of the cutting fluid action is complex and not fully understood. Efforts at standardization have not been wholly successful to date and it is most difficult to set up recommendation charts which can take into account all of the variations encountered in shop practice. Nevertheless, more is known today through the research work of many prom-

(*Turn to page* 462, *please*)

New Developments in

AUTOMOTIVE

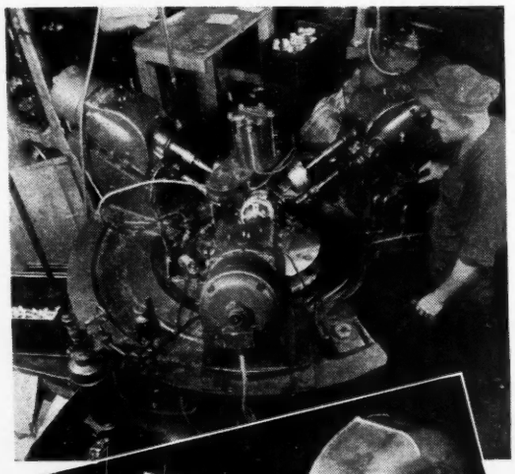
Die Castings on 1940 Cars

The accompanying three illustrations (below) supplement Herbert Chase's article published in the Oct. 1 issue of AUTOMOTIVE INDUSTRIES on page 308.

No. 1. Shows Studebaker steering wheel hubs, produced by the Steward Die Casting Division of the Stewart-Warner Corp., require that the 15 holes for spokes be drilled out. This work is done on the three-head Kingsbury machine here shown, the hub being held in a central fixture. Each Kingsbury unit is equipped with a five-spindle drilling head. Control of the units and of the locking device is from a single valve at the operator's right. Data as to production rate not furnished.

No. 2. The steering wheel hub, referred to, and an automobile heater housing, mentioned in the following caption, are here shown before and after machining, the finished items being on the left, and both being produced by Stewart.

No. 3. Automobile heater housings, several of which are seen in the tote box at right, are cast with a gate at the center of the front opening, runners from the gate extending radially, as shown in the preceding illustration. Space between runners is partly filled with flash. This is a thin wall casting in zinc alloy and the small and large holes at the side are punched, rather than being cored. To remove the gate, runners and flash, the housing is placed in the die shown, in a Bliss press, and the punch shears the flash and runners cleanly, leaving the central hole clear, accurately sized and with smooth edges. Information furnished does not state whether the side holes are punched simultaneously or in a separate operation and rates for the operations are not given.



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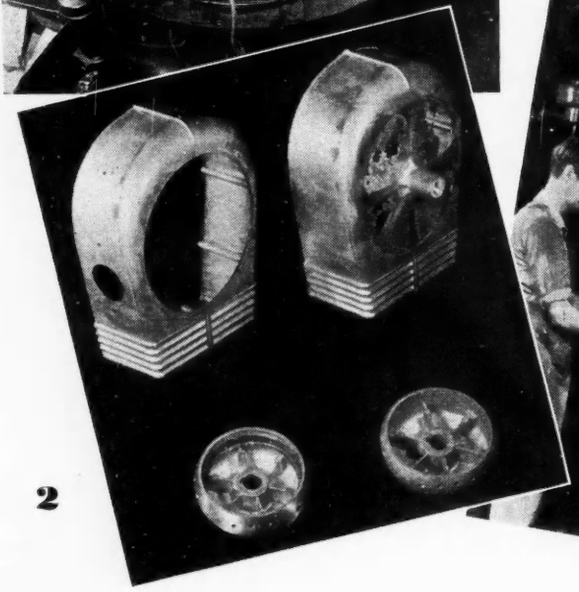


2

3

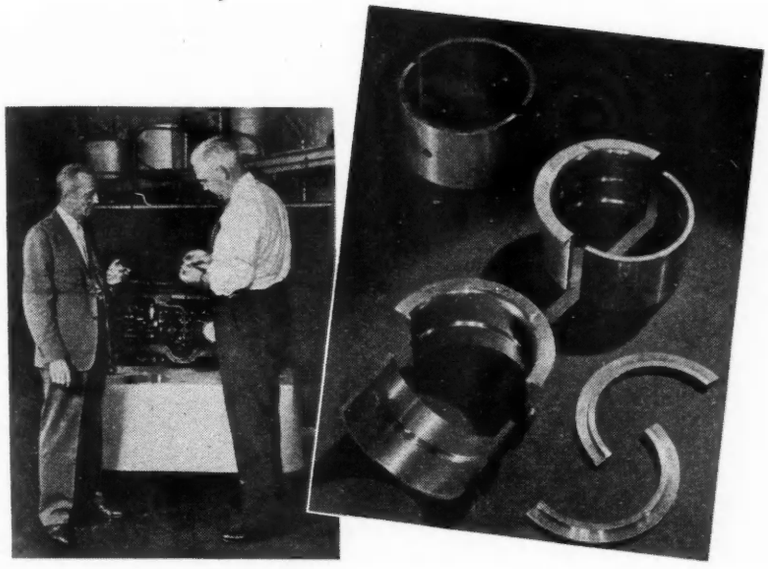
"Moly-Black" Molybdenum-Nickel Electroplating Process by duPont

A black plating process which is said to produce lustrous, deep black electrodeposits superior in color to any before known has been developed by E. I. duPont de Nemours & Co. It is based on a combination of molybdenum and nickel, available in plating salt form. The process operates at a high rate of deposition at low current densities, 20 times more rapidly than nickel under identical conditions. Its throwing power is reported to be higher than any other plating system, giving deposits of uniform thickness even in deep irregular recesses. Analysis of the deposit shows that it contains 45 per cent molybdenum and 10 per cent nickel, the balance being chiefly oxygen.

The coating is applicable to bases of zinc; aluminum; cadmium electroplated on brass, iron or steel; tin, either electroplated or hot-dipped; nickel; and steel or

MATERIALS . . .

A new aluminun alloy and stainless steel "lumber" have presented themselves on the automotive horizon as well as new developments in plastics, die casting and plating.



L. W. Kempf, research metallurgist, and Frank Jardine, chief automotive engineer, Aluminum Co. of America, examine the company's new aluminum alloy automotive bearing. Mr. Kempf was the co-author of an article on corrosion resistance of aluminum cylinder heads which appeared in AUTOMOTIVE INDUSTRIES, *Aug. 15, p. 156.*

The Aluminum Co. of America's new aluminum alloy bearing which may be used in bus, tractor, truck, Diesel and airplane service

iron. It also may be plated directly over aluminum prepared only by cleaning in an alkaline bath. Deposits are of low density, with a maximum thickness of about 0.002 in.

This "Moly-Black" molybdenum-nickel electroplating process deposits that are sufficiently black to escape color refraction under an intense beam of light in a dark room.

New Aluminun Alloy Automotive Bearing

Development of a new aluminum alloy automotive bearing culminates several years of intensive research in the laboratories of the Cleveland, Ohio, works of the Aluminum Co. of America. The work was done under the joint direction of L. W. Kempf, research metallurgist, and Frank Jardine, chief automotive engineer.

On the basis of tests made, the advantages of the new product are listed as follows: 1. A fatigue strength many times that of conventional bimetallic bearings used for the same purpose; 2. High resistance to corrosion by breakdown products of lubricating oils; and, 3. Economical construction because one metal does the job of two or more.

The all-aluminum bearings are said to have a superior resistance to fatigue. In a fatigue-testing machine, used for bearing tests, one bimetallic bearing failed at 20 hr., a second at 74 hr., while at 100 hr. the aluminum bearing was still in perfect condition. It was also found that the aluminum bearings were satisfactory as far as friction is concerned. Fabrication of the aluminum bearing is not difficult and customary methods of finishing can be employed. The main requirement is that the bearing be properly cast of the correct alloy with a thickness of at least 0.09 in. For main and rod bearings permanent mold castings are used, and rolled sheet is used for camshaft bearings.

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Automotive MATERIALS 32

Suggested Modifications in Gear

By P. M. HELDT

IT HAS long been known that the Lewis formula for calculating the strength of gear teeth is far from accurate. It errs on the side of safety, in that it assumes that the whole of the load on the gear at times comes on a single tooth, at the top thereof. With carefully-cut gears this could happen only if both the gear and the pinion had a very small number of teeth—smaller than used in practice. It would mean a duration of tooth contact equal to only one tooth interval. With standard stub-tooth gears with 20-deg. pressure angle, the duration of tooth contact is equal to 1.185 tooth intervals even if both mating gears have only 12 teeth each, and it is greater with a larger number of teeth in either one or both of the mating gears.

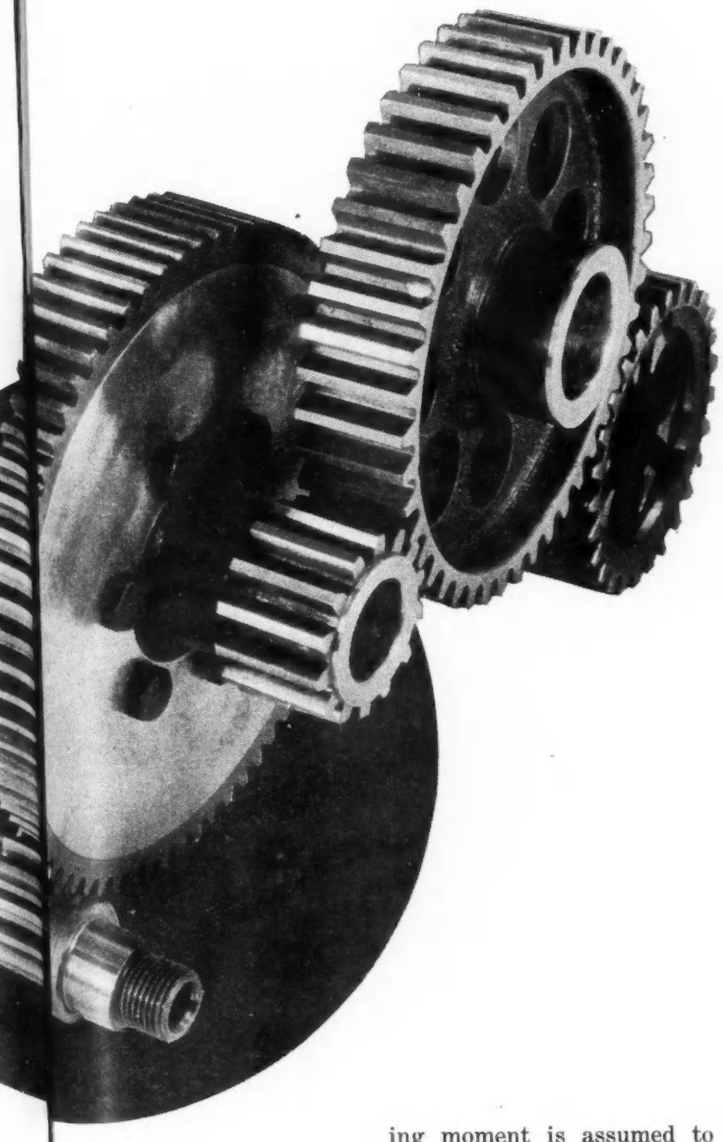
If the Lewis formula were equally far on the safe side for gears of all proportions, this defect would not be a serious one, as it would mean that a small factor of safety were included in the formula, and the factor of safety introduced when setting the working stress could be made correspondingly lower. The chief objection to it is that whereas it involves only a slight error when applied to gears with a minimum number of teeth, the error is much greater in the case of gears with large numbers of teeth and of gear and rack combinations.

In gears of the proportions most commonly used, all of the load is taken on a single tooth part of the time, and on two teeth during the remainder. On the pinion or driving member, tooth contact begins at the bottom of the active depth and ends at the top, but before the point of contact has reached the top of the tooth, the next following tooth has come into action, and the load is then shared between two teeth. The bending stress on any one tooth is a maximum at the very moment when the next tooth comes into action. During the period that all of the load is taken by a single tooth, the point of contact travels up on the tooth; this, of course, slightly reduces the tangential force applied to the tooth, which is inversely proportional to the distance of the point of contact from the gear axis; but the moment arm increases more rapidly than the force decreases, hence the moment tending to break the tooth is a maximum at the instant the next-following tooth becomes active, or immediately preceding it. Thus, in determining the maximum bending stress which can be produced in the teeth, we should consider the tooth load applied at the point of the leading face of the active tooth at which there is contact at the moment when the next-following tooth comes into action. This is illustrated in Fig. 1, which shows two 15-tooth, 20-deg.-pressure-angle, standard stub-tooth gears in mesh with each other. The gears are so drawn that a new tooth of the driving gear (or pinion) is just coming into action. Hence the full tooth load is still taken by the preceding tooth, the one at the right. It takes the load at the point indicated by the three arrow heads, which marks the intersection of the line of action with the active tooth face. The line of action is a straight line passing through the pitch point and making an angle equal to the complement of the pressure angle with the line of centers—the line connecting the center points of the two mating gears.

The contact pressure between the two teeth, which acts in the direction normal to the contact surface, may be resolved into two components, viz., a component parallel with the root or weakest section of the tooth, and a component perpendicular to that section. The former component produces bending stresses in the tooth, while the latter subjects the material of the tooth to compression. In the derivation of the Lewis formula, only the former is taken into account, the perpendicular component being disregarded. However, it can readily be seen that since the "parallel" component subjects the material of the tooth at the weakest section to tension on the pressure side and to compression on the non-pressure side, and the perpendicular component produces or tends to produce compressive stresses over the whole of the weakest section, the actual stress at any point of the weakest section depends on both the "parallel" and the "perpendicular" components of the tooth pressure, and both therefore should be considered.

In the derivation of the Lewis formula, while the tooth is supposed to take the load at the top, the bend-

Teeth Formula



ing moment is assumed to be applied at the point where the line of action intersects the radial center line of the tooth, rather than where it intersects the driving face of the tooth. The reason for this assumption is difficult to understand, unless it be that it was intended to partly compensate for the error involved in assuming that the whole of the tooth load is taken by the tooth at its top. Actually the load is taken on the side of the tooth, not on the center line thereof. A bending moment is created by that component of the tooth load which is parallel with the root of weakest section, and the moment arm through which this component acts is equal to the distance of the point (or line) of contact from the root, and not to the distance of the point of intersection of the line of action with the radial center line from the root.

To determine the stress created in the weakest section by the bending moment due to the parallel component, we must first determine the value of this component. This can be readily done if the torque load carried by the gears is known. Calling this torque load T (lb-in.), and the distance from the line of action of the parallel component to the axis of the gear r_1 (in.), the parallel component evidently is equal to T/r_1 lb. It is usual to refer the tangential force on the gear to the pitch circle, which has a somewhat smaller radius r, and a parallel component T/r_1 corresponds to a tangential force T/r on the pitch circle. In other words, the tangential force on the pitch circle is r_1/r times as large as the parallel component of the tooth load. This ratio can be conveniently incorporated in the "tooth-form" factor.

The method of calculating the beam strength of the tooth is generally illustrated by drawing a parabola inside the tooth section, with its apex at the point of intersection of the parallel component (or bending force) with the radial center line of the tooth and with its legs passing through the ends of the base line or root of the tooth. This parabola represents the longitudinal section of a cantilever beam which is stressed equally at all transverse sections (see Fig. 1). Denoting the parallel component by F and the distance between its line of action and the root of the tooth by l, the bending moment is Fl. This is equal to the resisting moment of the root section, which is $wt^2S/6$, where w is the face width of the tooth; t, its thickness at the weakest section, and S, the stress induced by the bending moment in the material at the weakest section. We therefore have

$$Fl = \frac{wt^2S}{6} \quad \text{and} \quad F = \frac{t^2}{6l}\,wS.$$

Now, it can be seen from Fig. 2 that, according to the principle of similar triangles,

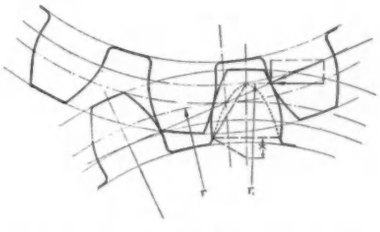


Fig. 1 — Showing two 15-tooth 20-deg. pressure-angle standard stub-tooth gears in mesh

GEAR DESIGN

$$x : \frac{t}{2} = \frac{t}{2} : l,$$

so that

$$x = \frac{t^2}{4l}.$$

Substituting this in the equation for F we get

$$F = \frac{xwS}{1.5}.$$

Multiplying both the numerator and denominator of the above expression for F by p (the circular pitch) we get

$$F = \frac{xwpS}{1.5p},$$

and by now making $y = x/(1.5\ p)$ we get

$$F = wpyS,$$

which is the familiar Lewis formula.

However, the factor y in this equation has a different value from that usually given in tables of tooth-form factors for use with the Lewis formula, as in its graphical determination the tooth load, instead of being assumed to act at the very top of the tooth, is assumed to act some distance down its side, at the point where tooth contact occurs when the next-following tooth comes into action, and also because the tangential force is assumed to act at the point of contact on the tooth surface instead of at the point of intersection of the line of action with the radial center line of the tooth. The Lewis tooth-form factor depends only on the number of teeth in the gear under consideration, the pressure angle, and the values of the addendum and dedendum in terms of the circular pitch, whereas the value of the y factor determined by the

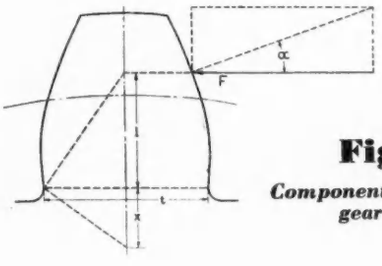


Fig. 2

Components of load on gear tooth

method here outlined depends also on the number of teeth in the mating gear. This is due to the fact that if the mating gear has a large number of teeth, the point of tooth contact on the gear under consideration at the moment the next-following tooth comes into action, is farther down the side of the tooth, and the lever arm l therefore is shorter.

This is brought out clearly by a comparison of Fig. 1 with Fig. 3, which latter shows the same 15-tooth pinion represented in Fig. 1, in mesh with a rack, and the point of contact will be seen to be considerably closer to the pitch circle.

Using this method to determine the y factors, we get values which are materially larger than those usually given for use with the Lewis formula, especially for gears with large numbers of teeth. For instance, whereas the usual form factor for a 15-tooth, 20-deg.-pressure-angle, stub-tooth gear is 0.111, by the above-described method we get a tooth-form factor of 0.115 for a 15-tooth pinion meshing with a 15-tooth gear, and 0.132 for a 15-tooth pinion meshing with a 60-tooth gear. Also, whereas the usual form factor for a 60-tooth, 20-deg.-pressure-angle, stub-tooth gear is 0.154, by the above-described method we obtain 0.215 for the form factor for a 60-tooth pinion meshing with a 60-tooth gear.

That the method of calculating the beam strength of gear teeth by assuming that one tooth takes the full load only when the next-following gear comes into

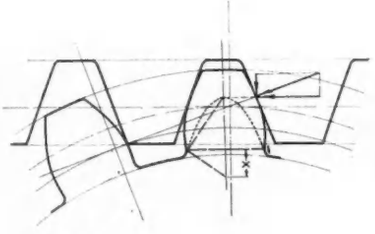


Fig. 3

Showing 15-tooth 20-deg. pressure - angle standard stub tooth pinion in mesh with rack

action gives more rational results than the method which assumes the entire tooth load to be taken at the top of the tooth, is borne out by experimental results. Endurance tests on rear-axle bevel gears were carried out by J. O. Almen of the General Motors Research Laboratories, and the limiting safe loads were plotted against the beam strengths of the teeth as determined by various formulas. Mr. Almen found that the test results correlated much more closely with the beam strengths calculated by a method developed by O. W. McMullan, which corresponds to that outlined in the foregoing, than with the results obtained with the Lewis formula.

Further modifications should be applied to the tooth-form factor to take account of the change in the stress in the weakest section of the tooth due to the perpendicular component of the tooth pressure, and so that the stress in the weakest section can be based on the tangential load on the pitch circle instead of on the tangential force at the point of contact. Both of these modifications or corrections will further increase the tooth-form factors.

The value of the perpendicular component can be found by measuring the angle α between the line of action and the weakest section of the tooth at the moment the tooth carries its maximum load, which can be readily done on the drawing. This angle is usually somewhat greater than the pressure angle. The perpendicular component, which is equal to $F \tan \alpha$, passes through the root section not far from the pressure side of the tooth and causes—or tends to cause—compression in this part of the tooth. Since the bending moment due to the parallel component causes tension, the actual stress at the edge of the weakest section on the pressure side of the tooth is

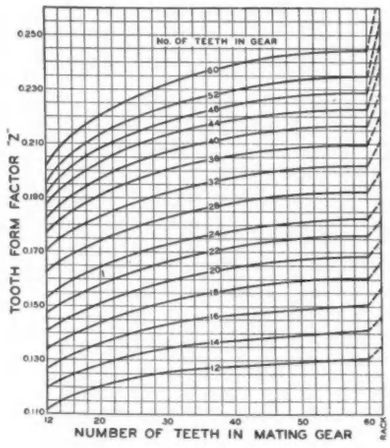


Fig. 4

Chart of tooth-form factors for 20-deg. pressure-angle standard stub-tooth gears

equal to the difference between the stresses which would be caused there by the parallel component and the perpendicular component if they acted separately. The tension caused by the parallel component is always much greater than the compression caused by the perpendicular component, and the actual stress therefore is a tension.

The perpendicular component is a concentrated force, and the stress produced by it in the weakest section is non-uniform over the thickness of the tooth. It will be a maximum directly below the point of contact and decrease from there toward both sides of the tooth. Although it is possible to determine the stress distribution under concentrated loads for various simple cases, such as that of a long plate having a concentrated load applied to it along a line across its top edge perpendicular to its sides, and that of a wedge having a load applied to its edge, the conditions determining the stress distribution in a gear tooth under a concentrated radial load applied to its side are so complicated as to baffle analytical determination. The particular stress intensity which it would be desirable to know is that at the edge of the weakest section on the pressure side of the tooth. This is evidently less than the maximum intensity of stress, which is directly below the point of application of the compressive force, and greater than the minimum intensity, which occurs at the opposite edge of the section; hence we cannot be far wrong in assuming that it is approximately equal to the mean stress in the weakest section due to the compressive force. Any error resulting from this assumption is on the safe side, in that the virtual compression on the pressure side will be greater than the mean virtual compression, and as this is a negative stress, any increase in it reduces the actual stress. Taking account of the perpendicular component of the tooth load in this way changes the value of the tooth-form factor approximately 10 per cent on the average, so that even if there were an error of 20 per cent in the assumption regarding the value of the virtual stress in the weakest section on the pressure-side of the tooth due to this component, the resulting error in the tooth-form factor would amount to only 2 per cent.

We found in the foregoing that the tensile stress produced in the weakest section by the bending moment due to the parallel component of the tooth pressure is $(6Fl)/(wt^2)$. Since the value of the perpendicular component of the tooth pressure is $F \tan \alpha$, the mean compressive stress in the weakest section due to this component is $(F \tan \alpha)/(wt)$. If we take this to be the stress caused by this component in the weakest section on the pressure side of the tooth, then the real stress there is

$$(6Fl)/(wt^2) - (F \tan \alpha)/(wt).$$

Hence the perpendicular component of the tooth pressure reduces the actual stress at this point of the section in the proportion

$$\frac{(6Fl)/(wt^2) - (F \tan \alpha)/(wt)}{(6Fl)/(wt^2)},$$

and in order to take account of the effect of the perpendicular component we multiply the tooth-form factor by the inverse proportion, viz.,

$$\frac{(6Fl)/(wt^2)}{(6Fl)/(wt^2) - (F \tan \alpha)/(wt)} = \frac{6l}{6l - t \tan \alpha}$$

The form factor y in the conventional equation for the beam strength of a gear tooth has the value $y = x/(1.5p)$. To take account of the perpendicular component of the tooth pressure we multiply this value by $6l/6l$ — $\tan \alpha)$, which gives

$$\frac{x}{1.5p} \times \frac{6l}{6l - t \tan \alpha} = \frac{4xl}{p(6l - t \tan \alpha)}$$

If now we want to figure with the tangential force F_p on the pitch circle instead of the tangential force F at the point of tooth contact, we multiply this expression by the ratio r_1/r, and to distinguish it from the old tooth form factor we will designate it by z. This gives

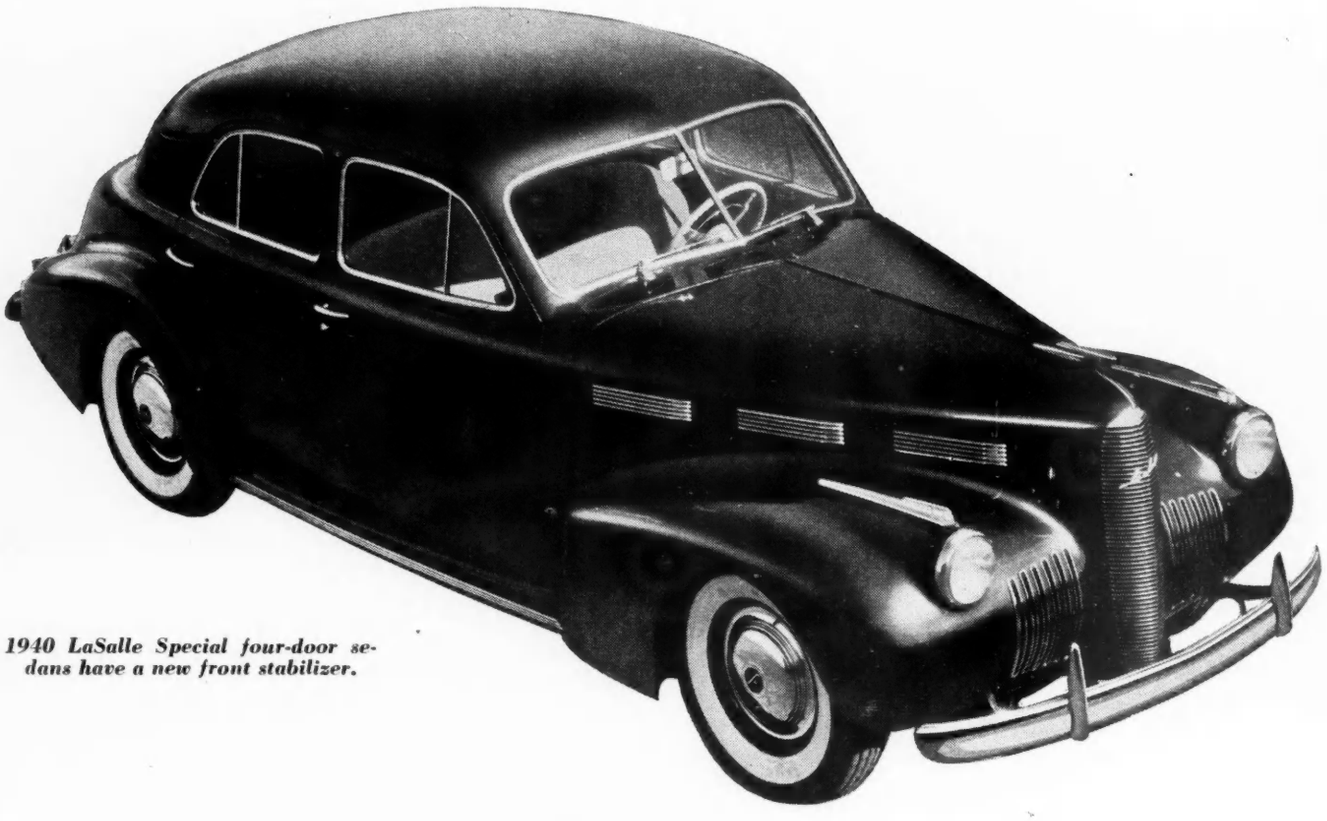
$$z = \frac{4xlr_1}{pr(6l - t \tan \alpha)},$$

where x, l, r, r_1 and α represent the magnitudes indicated on the drawings in Figs. 1 and 2 and p is the circular pitch of the gear. Values of z are to be used in the following equation for the beam strength of gear teeth:

$$F_p = wpzS \text{ lb.},$$

where F_p is the tangential force on the pitch circle.

Values of z for standard stub-tooth gears with 20-deg. pressure angle, for different numbers of teeth in both the gear under consideration and the mating gear, have been calculated, and the values are plotted in Fig. 4. The tooth-form factors shown apply to gears with the number of teeth indicated by the figures on the curves when mating with gears having the number of teeth shown on the lower scale. It will be seen that the value of the tooth-form factor increases with the number of teeth in the gear under consideration, and more slowly with the number of teeth in the mating gear.



1940 LaSalle Special four-door sedans have a new front stabilizer.

Cadillac Blankets

SEVEN distinct lines of cars, blanketing the entire fine-car range, constitute the Cadillac offering for 1940. Three of the series are entirely new, and all models except the Sixteen feature new front-end styling with redesigned radiator grilles. The complete line includes the following: Series 50, LaSalle, with 123-in. wheelbase (3 in. longer than last year), offered again with a range of five Fisher bodies; Series 52, LaSalle Special, a new car of 123-in. wheelbase, offered in two new Fisher bodies; Series 62, Cadillac V-8, replacing the former Series 61, of 129-in. wheelbase (3 in. longer than last year) and with two new Fisher bodies; Series 60-S, Cadillac V-8, which remains unchanged except for front-end styling; Series 72, a new seven-passenger Cadillac V-8 of 139-in. wheelbase, with four Fleetwood bodies and two business body models; Series 75, Cadillac V-8, of 141-in. wheelbase, which remains unchanged except for the new front-end styling and which is offered in 12 Fleetwood body styles and two business models; Series 90, the Cadillac 16, of 141-in. wheelbase, which remains unchanged in chassis and styling and which can be had in 12 different Fleetwood body styles.

In addition to the foregoing, Cadillac has three commercial chassis, as follows: Series 50, of 159¼-in. wheelbase (approximately 3 in. longer than last year); Series 72, of 165¼-in. wheelbase (3 in. longer than last year), and Series 75, of 161 3/8-in. wheelbase (the same as last year).

Major features of the 1940 offering include an outstanding body on Series 52 and 62; new front-end styling on all models except the Sixteen; sealed-beam headlamps, a switch-operated direction signal controlling the parking lamp and stop light on the right or left side simultaneously, which is standard on all models; adoption on all models of luxurious cushions consisting of a nested-spring foundation with a thick pad of soft latex-foam sponge rubber, covered by a suitable padding, which in turn is covered by the upholstery material; an option on two types of car-heating equipment, and the Saginaw continuous-ball-type steering gear as standard equipment on Series 72.

Running boards are optional on Series 50, 52, and 62, and may be added or removed "in the field." If they are omitted, the body skirt is fitted with a stainless-steel molding. The 60-S body is standard without running boards, as before.

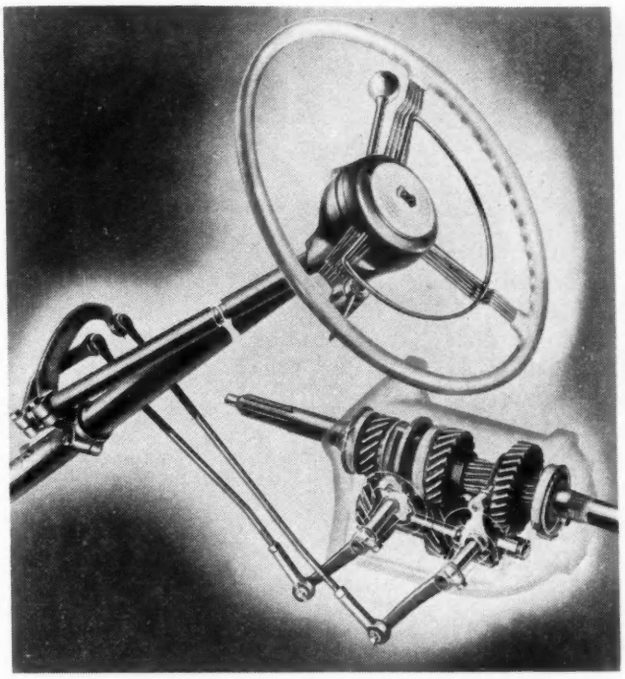
On Series 50 and 52 the LaSalle V-8 engine is used; it is an L-head, 90-deg. V-8 of 3⅜-in. bore by 4½-in. stroke (322 cu. in. displacement) which is rated 130 hp. at 3400 r.p.m. (5 hp. more than last year), with the same compression ratio of 6.25. Lynite and Bohnalite pistons with T slots, anodized, are standard.

These engines are fitted with Carter carburetors

having a throat diameter of 1¼ in.—an increase of ⅛ in. Improvement in fuel economy is effected by the adoption of a new vacuum metering system. Accelerator pump jets have been redesigned to provide a shorter and straighter fuel path. In addition, the carburetor has been fitted with an "anti-percolating" vent.

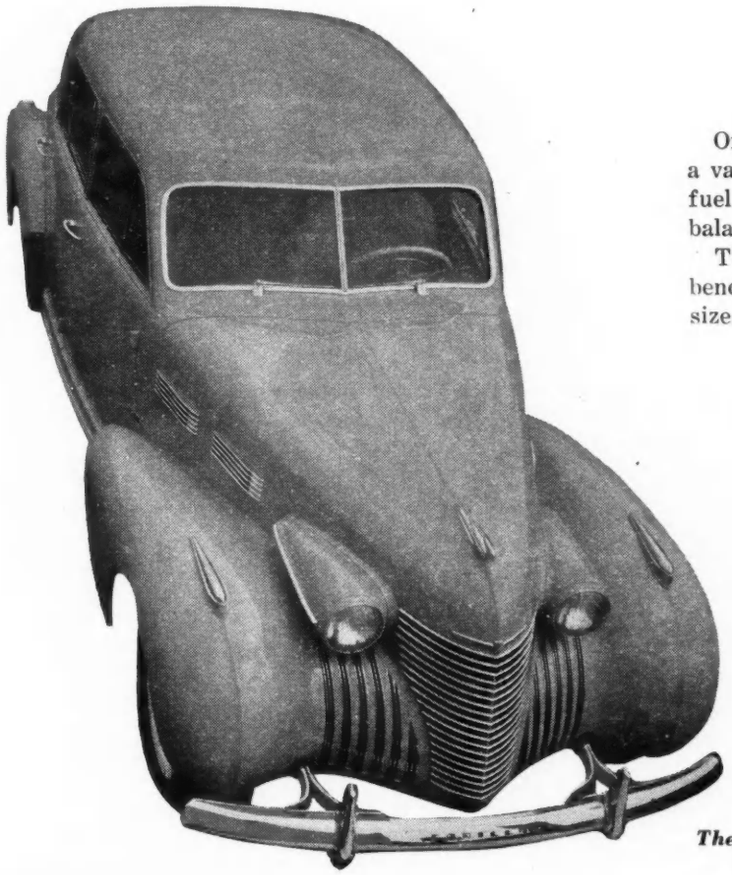
The Cadillac V-8 engine, used on Series 60-S, 62, 72, and 75, is continued unchanged except as regards details. This is an L-head, 90-deg. V-8 of 3½ in. bore by 4½ in. stroke (346 cu. in. displacement). As used on the Series 60-S and 62 it is rated 135 hp. at 3400 r.p.m. with a compression ratio of 6.25; as used on Series 72 and 75 it is rated 140 hp. at 3400 r.p.m., with a compression ratio of 6.7.

Stromberg carburetors are continued with minor changes on Cadillac V-8s. Fuel-pump capacities have been increased materially by boosting the pump compression ratio. On both Cadillac and LaSalle V-8s the intake manifold has been redesigned to extend parallel with the ground. This improves the distribution, particularly when starting from cold.



Shifting levers on the Cadillac and LaSalle models have been lengthened, leading directly into the transmission and are attached to long shifter rods.

Fine Car Field



On all V-8s the ignition distributor now incorporates a vacuum spark-advance, which is said to improve the fuel economy. The timing disk is curved above the balancer, and timing marks are now on the disk.

The long semi-centrifugal clutch with the new Torbend disk is standard equipment on all models. Clutch sizes are as follows: Series 50 and 52, 10 in.; Series 60-S and 62, 10½ in.; Series 72 and 75, 11 in., and Series 90, 11½ in.

Electrically there are many improvements. The generator, which now has a rating of 34 amperes, has glass-insulated armature windings. All series now have automatic voltage-current regulation. On the 50, 52, 62 and 72 the battery is located under the floorboards on the left side, while on the 60-S, 75 and 90 it is under the right front fender.

The Cadillac 16 engine is an L-head, 135-deg, V-16 of 3¼-in. bore by 3¼-in. stroke

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The Cadillac Sixty Special has a new front design. Running boards are optional.

Pontiac Makes Strong

FOUR SERIES, two of them with entirely new bodies, constitute the Pontiac line for the 1940 season. Series 40-25 is the Six with 117-in. wheelbase—2 in. longer than last year. It has a newly-styled body available in two and four-door touring sedans, business and sport coupes.

Series 40-26, the Six with 120-in. wheelbase, remains substantially the same as last year, except for refinements in the engine and chassis.

Series 40-28, the Straight Eight with 120-in. wheelbase, remains substantially unchanged in specifications but shows marked advances in styling and appointments.

Series 40-29, the Straight Eight of 122-in. wheelbase (2 in. longer than last year), has an entirely new type of body which is available only in four-door touring sedan and sport coupe models. This series incorporates the same improvements that have been made in Series 40-28, besides which it has a new frame.

In addition, a station-wagon body is offered on the Series 40-25 chassis, and a taxicab body is available on both Series 40-25 and Series 40-26 chassis.

Chrome-trimmed running boards or running-board skirts are optional on the Series 26, 28, 29. The Series 25 comes regularly with chrome-trimmed running boards and carries no option.

Significant powerplant specifications remain unchanged, as follows: Series 40-25 and 40-26, L-head six-cylinder engine of 3 7/16-in. bore by 4-in. stroke, 222.7 cu. in. displacement, rated 87 hp. at 3500 rpm. Series 40-28, L-head straight-eight engine of 3¼-in. bore by 3 ¾-in. stroke, 248.9 cu. in. displacement, rated 100 hp. at 3600 rpm.; Series 40-29, the same engine fitted with dual carburetor, rated 103 hp. at 3600 rpm. The compression ratio of both engines has been raised from 6.2 to 6.5.

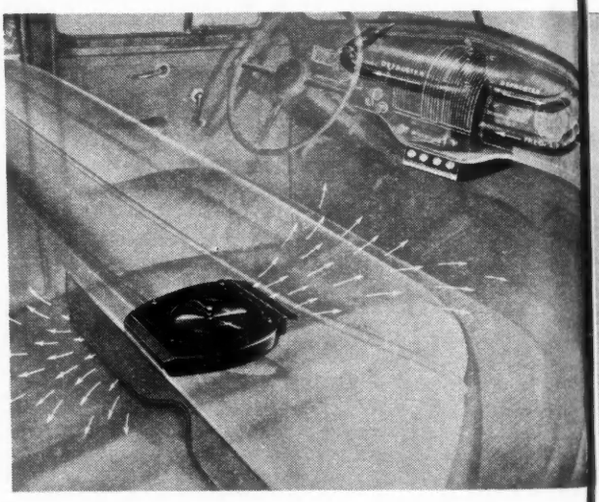
The newly developed sealed-beam headlamps, with greater illuminating capacity and better service facility, are standard on all models. Parking lamps are a part of the fender-mounted headlamps. This makes it possible for Pontiac to offer as optional equipment a new type of direction signal which flashes the parking lamp and stop light simultaneously, on either the right or left side, when approaching a turn. It is controlled by a switch lever mounted on the steering column.

Another minor feature—found on the Model 40-29 only—is the concealed fuel tank filler, separate from the rear fender, which is made accessible by lifting a spring-tensioned door in the fender.

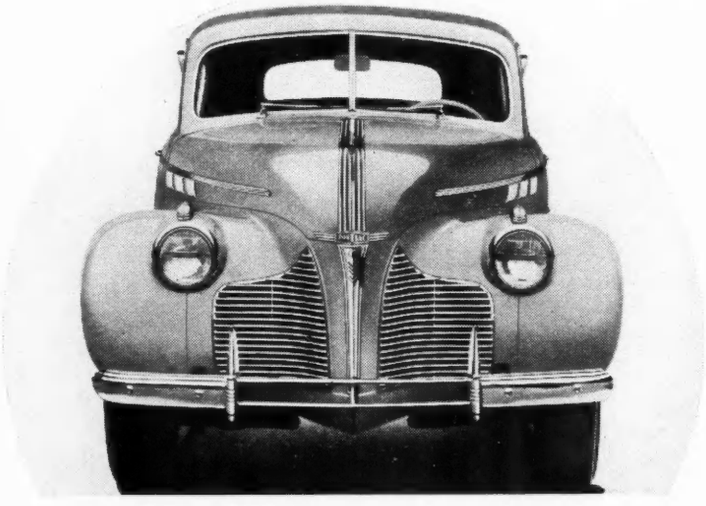
Rear-axle reduction ratios have been lowered, with a resulting increase in top speed, and without loss in acceleration, it is claimed.

New shear-type engine mountings are used, in the same positions as before. These mountings permit slightly more freedom about the neutral axis, but restrain up-and-down, side-wise, and fore-and-aft movement.

On the six-cylinder engine there is a new cylinder

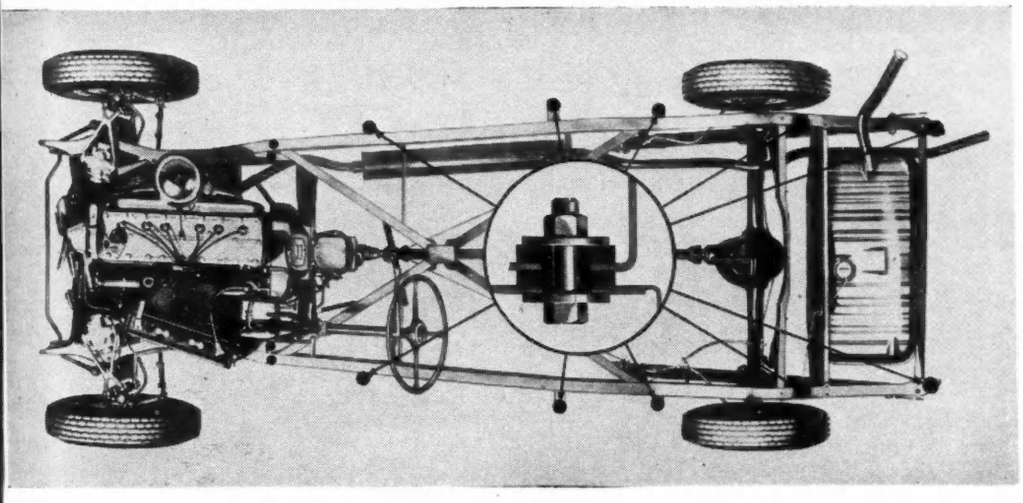


Type of heating available with the 1940 Pontiac is the under-seat heater. From its central position under the front seat it distributes warm air throughout both front and rear compartments. Also shown is the special defroster and fresh air intake.



New front end design still retains the silver streak. Here is the Torpedo Eight four door sedan. All Pontiac models for 1940 are marked by more liberal use of chromium for decorative effects.

Bid for 1940



The Pontiac Deluxe Six two door sedan for 1940 is powered by an 87 horsepower engine and mounted on a 120 inch chassis.

The new mountings consist of vulcanized rubber and cotton shims placed between the body and frame and between the frame and the hold-down bolt nuts.

head in which the spark plug is located directly over the intake valve. The new combustion chamber contour, with reduced volume directly over the cylinder bore, is said to give better combustion control and volumetric efficiency. The cylinder head for the Eight is continued without change, except for the increase in the compression ratio to 6.5, the combustion chamber being of the double-button type.

Granodized valve lifters are standard on both engines.

The one-piece exhaust-and-intake manifold developed for last year's Six remains unchanged, except for an enlargement of the two center branches on the intake manifold, which is said to improve the distribution. A similar manifold design has been developed for use on the Eight. The exhaust damper is provided with positive internal stops for both the open and closed positions.

Carter 1¼-in. carburetors with built-in automatic choke are used on both the Six and Eight. On the latter, however, the throat diameter has been increased by ⅛ in. This carburetor has a stop in the accelerator-pump cylinder, which limits the piston travel to 30 deg. of throttle-valve opening. On this model the idler bleed is relocated to place it in the path of the mixture.

The ventilator inlet and the oil-filter cap have been combined in a single unit, and a copper-ribbon filter has been added in the ventilator-outlet pipe.

Self-locking connecting-rod bolts replace the bolts with castellated nuts and cotters formerly used. The single-spring clutch used last year is continued unchanged, except that the method of fastening the clutch-throwout bearing plate has been improved.

In the remote-control shifting mechanism the pull-type cable selector has been discarded in favor of positive rod-and-lever control for both shifting and

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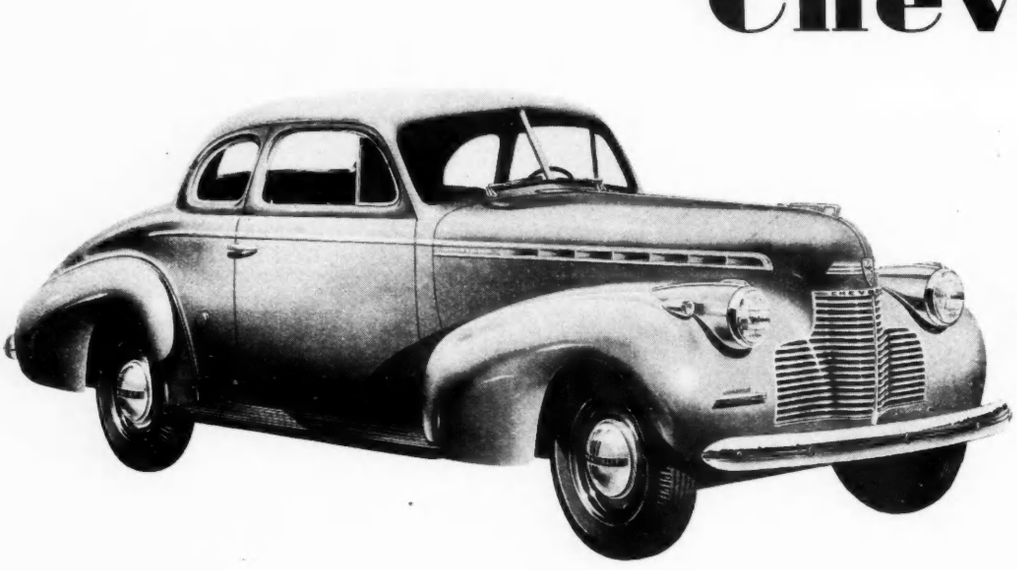
Chevrolet i



New 1940 Chevrolet Master 85 business coupe

Transmission housing showing mounting of the vacuum power shift mechanism

CHEVROLET has groomed three different lines for the 1940 market—the Special DeLuxe, Master DeLuxe, and Master 85. These cars have new front-end styling with enhanced eye appeal; entirely new bodies, wider and roomier, somewhat heavier, and structurally stronger than previous designs. The wheelbase on all models has been increased to 113 in. and the engine moved forward, the combined effect being an increase of 4¼ in. in bumper-to-bumper length.

Appearance features, such as front-end styling, body, fenders, etc., are the same on all three series, except for decorative details. The hood is of the alligator type, with an automatic latch, and is locked by a control button on the instrument panel. Headlamps are mounted on top of the fenders and are considerably longer than last year. Sealed-beam lighting is standard equipment.

Mechanically, the Special DeLuxe and Master DeLuxe are alike, while the Master 85 differs from the other two chiefly as regards the front suspension.

Vacuum gearshift now is standard equipment on all models. The hook-up has been further simplified and improved in appearance, by locating the housing directly above the steering column.

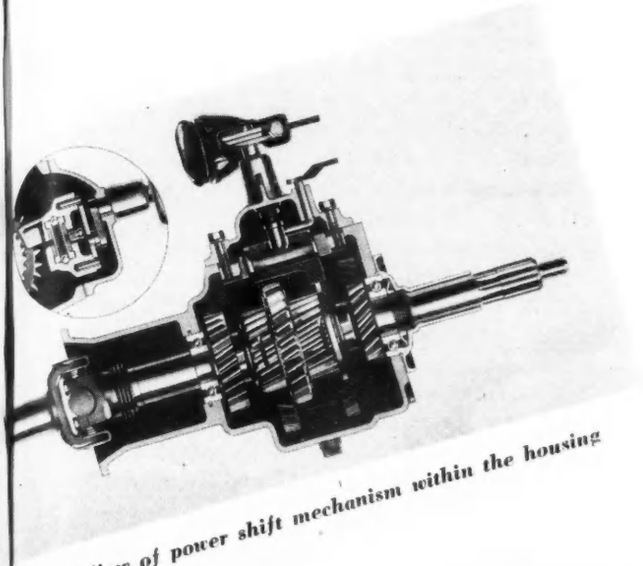
The engine is a six-cylinder valve-in-head type of 3½ in. bore by 3¾ in. stroke (216.5 cu. in. displacement) with a cast-iron head and 6.25 compression ratio, rated 85 hp. at 3200 r.p.m. Light cast-iron pistons with domed head are continued.

The engine has been moved forward 1½ in., and raised at the front end, so that the crankshaft is inclined 3¾ deg. This lowers the front end of the propeller shaft and reduces the depth of the tunnel in the rear compartment.

The carburetor is a Carter single-adjustment, balanced down-draft unit with an accelerating pump. To compensate for the inclination of the engine, the flange on the intake manifold is faced off at an angle.

Valve timing has been retarded six degrees, by changing the location of the keyway in the timing gear. The range of spark timing has been reduced from 46 deg. to 33 deg. Valve tappets have been redesigned to permit of shortening the pushrods about 2 in., to make them stiffer. The pushrod seat is moved from the bottom to the top of the tappet, where it is a separate piece with hardened and smoothly finished contact surface. Both ends of the pushrod are hard-

is Longer for '40



View of power shift mechanism within the housing

ened and smooth. Tips of valve stems also are hardened. Rocker-arm shafts are heat treated to increase the hardness of the bearing surfaces.

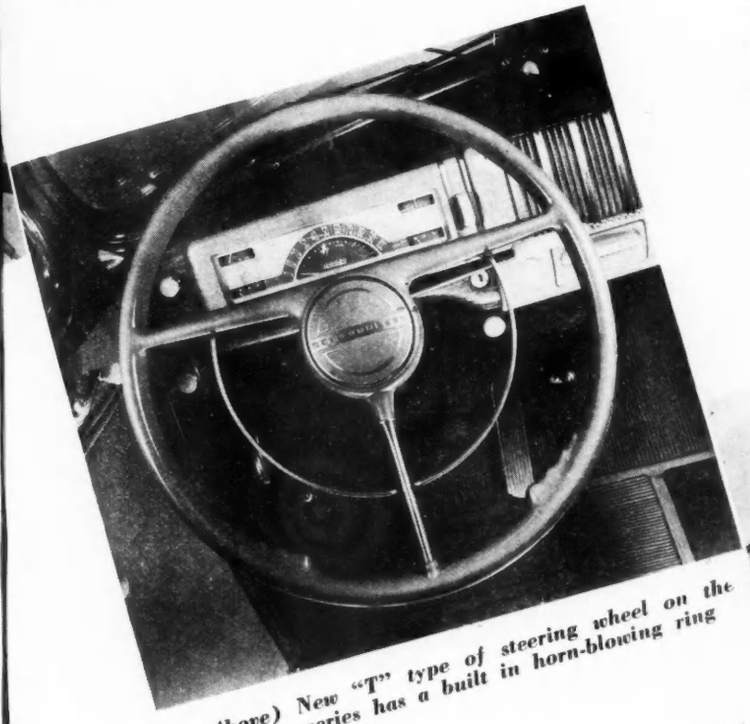
The oil-pump capacity has been increased by using gears of wider face and improving the suction-pipe connection to the oil screen. The screen is new and is mounted on the rear intermediate bearing cap, instead of on the oil-pump body. The oil-pump distributor body now is integral with the crankcase, with a cover over the opening, to provide adequate clearance for the new exhaust pipe.

The counterweight on the heat-valve shaft has been redesigned. A wick-type oil seal replaces the oil slinger at the rear end of the crankshaft. There are now four fastening bolts in the rear bearing cap, instead of two. Two dowels are used in addition, and the ball check is eliminated.

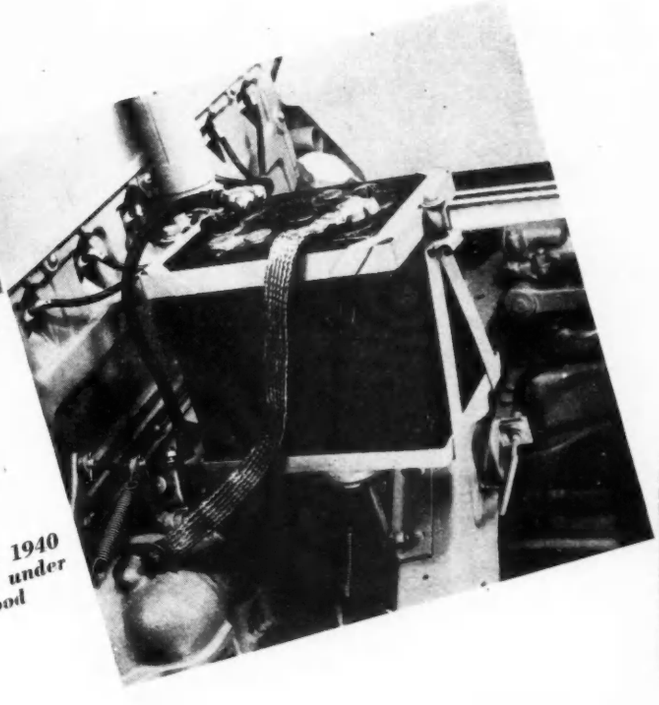
The clutch housing has been made stiffer by spreading the attachment bolts at the transmission and redesigning the ribs. Clutch and brake pedal arms now are stampings instead of forgings, and both are mounted on the housing of the brake master cylinder. Pin-type bearings are welded to the shanks of the arms and can be lubricated in a single operation through a removal plug on the master-cylinder housing.

Cushions of clockspring steel between the facings of the clutch disk afford smoother engagement and re-

(Turn to page 449 please)



(Above) New "T" type of steering wheel on the deluxe series has a built in horn-blowing ring



(Right) The battery on the 1940 models has a new location under the right side of the hood

Ford Lines Are

FORD MOTOR CO. for 1940 continues its Ford V-8, Mercury, and Lincoln Zephyr cars in new restyled versions, with such improvements as a finger-tip shift lever mounted on the steering column, sealed-beam headlamps, and a new ventilating system.

The Ford V-8 again comes in two types, the Ford V-8 and the Ford Deluxe V-8, of which the former may be had with a 60 hp. instead of the regular 85-hp. engine if desired.

Four Ford V-8 and five Deluxe body types comprise the two lines. A new business coupe as well as a Fordor sedan, Tudor sedan and coupe are available in both. There is also a Deluxe convertible club coupe with automatic top as standard equipment. Three color choices are available in the Ford V-8, six in the Leluxe line.

On the 85-hp. cars the transverse front spring is longer and more flexible, and a torsion-bar stabilizer steadies the car and improves its steering characteristics. Both springs of Deluxe cars are fitted with metal spring covers. Double-acting hydraulic shock absorbers of the self-sealing type are fitted on all Ford V8's and on the Mercury.

Front-seat backs are of a new resilient type, and cushions have a "floating" edge. Drivers' seats are adjustable and rise as they move forward. Curved disk wheels of new design and improved brake drums are carried on Ford cars.

Interiors of the Deluxe bodies are distinguished by a maroon-and-sand duotone treatment. Windows and door frames of Deluxe cars are finished in dark mahogany, hardware in maroon, knobs and escutcheon plates in sand, with striped mohair or broadcloth upholstery, also in sand. In the Ford V-8 the door and window mouldings are in bleached walnut finish; handles are chrome-plated, with knobs and escutcheons in sand-colored plastics. The upholstery is in taupe.

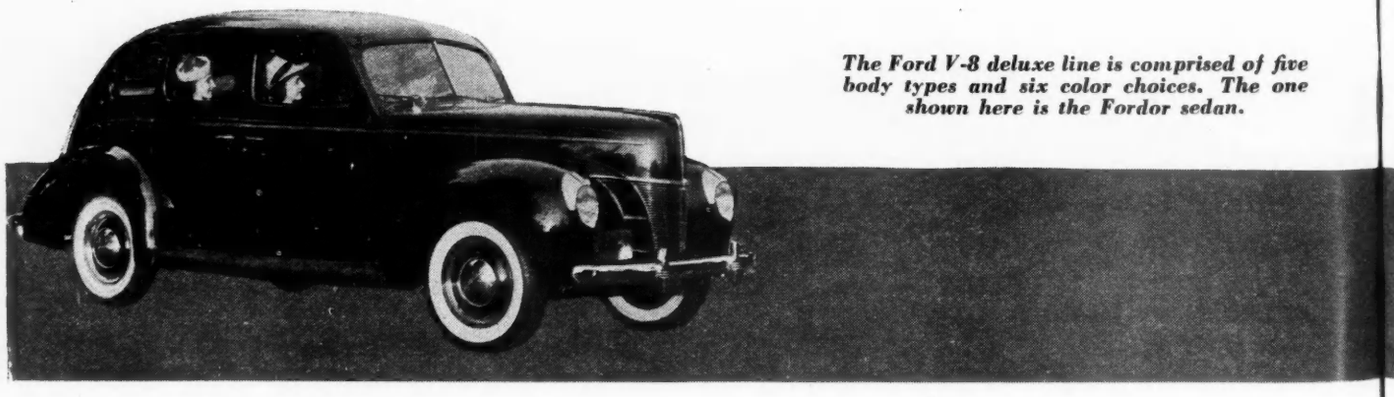
Gages are grouped in front of the two-spoked steering wheel. There is a grille for the installation of a radio speaker, and in addition there are a glove compartment with lock, two ash trays, and a cigar lighter.

A new convertible sedan appears among the five body types of the Mercury line, which also includes a four-door town sedan, a two-door sedan, a sedan-coupe and a club-convertible. The first four are six-passenger cars, while the club convertible seats five. Its top raises and lowers automatically. A choice of eight body colors is offered.

The Mercury instrument panel is in blue and silver tone. A new, straight-line speedometer, gages, and headlight-beam indicator are grouped in front of the two-spoke steering wheel. Upholstery is available in either blue-gray, dark-weave broadcloth, or two-tone Bedford cord in closed cars, and in saddle-brown or red antique-finish genuine leather in convertibles.

Another new feature is the "all-weather" ventilating system. The "tilting-wing" front section of window glass may be swung outward, while the rear half together with its metal support bar, can be lowered. Polished plate safety glass is used in windshields. Front seats are adjustable. Seat cushions in the new Mercury have deep, soft inner springs and soft edges. Both springs are provided with metal covers. The luggage compartment, in which the spare wheel is carried vertically against the front wall, is lighted automatically when the door is lifted.

Bodies of the Lincoln-Zephyr line are entirely new and more roomy. There is 22 per cent more glass area in the bodies. The windshield, unbroken by a middle support, is deeper and has 104 sq. in. more glass area.



The Ford V-8 deluxe line is comprised of five body types and six color choices. The one shown here is the Fordor sedan.

Restyled

Windows are wider and deeper, and the large rear window is of one-piece, tempered glass and conforms to the curvature of the body rear panel.

The V-12, L-head engine has a bore of 2⅞ in. (⅛ in. increase over the previous model) and a 3¾-in. stroke, giving 292 cu. in. displacement. It is rated 120 hp. at 3900 r.p.m. and uses aluminum heads with compression ratio of 6.7 to 1.

A lower hood, extending farther forward, and a new grille and ornament markedly change the frontal appearance of the Zephyr. The grille is that pioneered by Lincoln-Zephyr two years ago. Interiors are completely restyled. Dials and instruments are grouped in front of the driver, and there is a glove compartment at the right of the instrument board. Seats are of chair height, and running boards have been eliminated.

A club coupe and a Continental cabriolet have been added to the line, which also includes a four-door sedan, a town-limousine, a coupe, and a six-passenger convertible coupe. Tops which operate automatically are supplied in the convertible coupe and Continental cabriolet. Broadcloth or cord upholstery is offered in closed cars, leather in a choice of five colors, or a combination of leather and whipcord,

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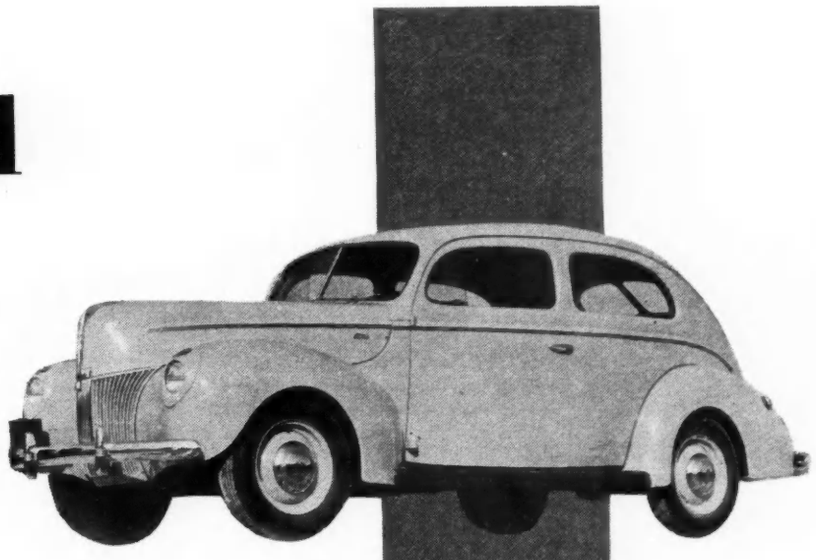
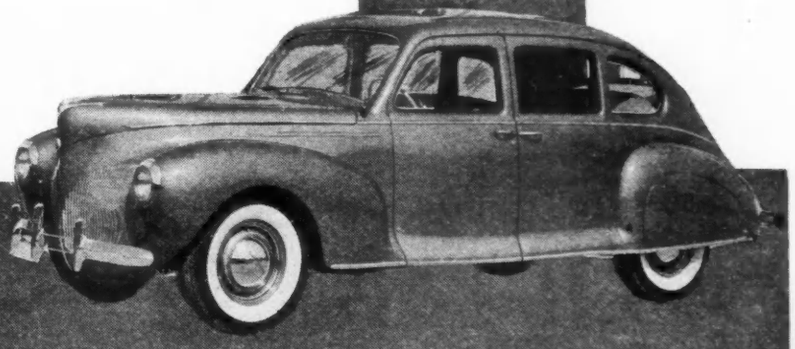


The Ford V-8 appears in a new style with a selection of four body models, in either of three color choices.

The new Mercury has an "all-weather" ventilating system, sealed head-lamps and a finger-tip shift-lever.



The new appearance of the front and interiors of the Lincoln-Zephyrs accompany the omission of running boards.

NEW CARS

New Developments in Automotive Materials

(*Continued from page* 427)

Use of the bearings is at present limited to engines for commercial vehicles which have hardened shafts and which operate for relatively lower speeds at the bearing surface than is usual in passenger-car engines. However, experiments are now under way to adapt the new bearing to passenger car engines. Since the same types of engines may be used in either buses, trucks or tractors, the aluminum bearing is suitable for these vehicles. It may be used on either gasoline engines or Diesels.

While aluminum is new as a material for main bearings, it has been used in aircraft cam-shaft bearings for 25 years. The old Liberty engine is an example. The other uses of aluminum as a bearing material have been aircraft valve tappet guides and wrist-pin bearings in aluminum pistons.

Developments In Wood Plastics

If the field of large molded products, such as automobile bodies, is to be invaded by plastics it is evident that such a plastic must be low in cost and available in great quantities. A survey of such prospective materials reveals that the woody portion of most vegetation is perhaps one of the most promising sources of raw material. Considerable research on wood plastics has been carried on in the Forest Products Laboratory of the Forest Service, United States Department of Agriculture. The results of this research to date are described in a paper prepared recently by several members of the Laboratory Staff, Messrs. E. C. Sherrard, principal chemical, Edward Beglinger and J. P. Hohf, assistant chemists.

The paper points out that wood alone, untreated, is somewhat plastic at elevated temperatures and by the application of sufficient pressure small particles can be pressed into a compact mass, but such pressed material does not have sufficient strength for structural purposes and it rapidly disintegrates on soaking in water. However, one of the main constituents of wood, lignin, when separated from the other constituents is more plastic and after pressing at elevated temperatures, is very resistant to water absorption.

The best pressing temperature for lignin is so near the point where it begins to decompose with heat that it is necessary to use plasticizers to obtain the best results and such plasticizers improve not only the plastic properties of the lignin, but also the water resistance of the pressed product. Such a pressed product from plasticized lignin alone, although very satisfactory in water resistance is too brittle for many uses —it needs a "filler" for improving its strength properties. This last situation, say the authors, is rather fortunate than otherwise, since complete removal of all the cellulosic material from wood would be an expensive process and by a comparatively simple treatment enough cellulose can be removed to render the lignin plastic, at the same time leaving enough cellulose to serve as a filler.

Several types of pretreatment have been employed in reducing the wood to a satisfactory lignin-cellulose mixture which can later, with the addition of plasticizer, be molded. Most attention has been given to pretreatments with the acid-hydrolysis and aniline-hydrolysis methods. By variation of time, temperature, and acid concentration in the acid-hydrolysis pretreatment the lignin to cellulose ratio can be controlled. It has been found that this ratio very largely determines the properties of the finished material, other things being equal. A low ratio of lignin to hydrolyzed cellulose will have high strength values and low water resistance, whereas the opposite effects will be obtained in a higher lignin-cellulose ratio.

Among suitable lignin plasticizers, the Forest Products Laboratory finds ketones, such as acetone, furoin, and benzoin; aldehydes, such as furfural and formaldehyde; amines, such as aniline, and ethanol amines; ethers, especially glycol ethers; esters, as of glycol, phosphoric and sulphonic acid esters of phenols and cresols, and phthalic and maleic anhydride; amides, such as urea, toluene ethyl sulphonamides, toluene sulphonamides, and cyclohexyl p-toluene sulphonamide; and mixtures, such as wood-tar oils.

The aniline-hydrolysis process has been found to produce the best molding material from the standpoint of the properties of the finished products: moldability, strength, water and electrical resistance, and uniformity. All the products, except those with very high lignin content, have high shock resistance, and are practically unaffected by exposure to ultraviolet light; in fact, samples exposed to ultraviolet light for more than 144 hours were blacker and shinier than before exposure.

Articles prepared from all of the compositions are black. Surface modifications may be made by the application of thin wood veneer, paper, paints, lacquers, or enamels, or by dusting the upper and lower surfaces of the material being molded with metallic powders, such as bronze or aluminum.

A chief point of interest in these plastic compositions is their cheapness. It is estimated that these molding powders can be made for three to four cents a pound by the acid-hydrolysis process and five to six cents a pound by the aniline-hydrolysis process, a cost which should make them readily available for large-scale molding. At the present time, work upon these materials is just emerging from the experimental scale. The ultimate use of these materials will depend entirely upon their properties when compared with plastics already in general use.

Oldsmobile for 1940

THREE lines of cars are offered by Oldsmobile for 1940. These are the Olds "60," a Six with five new bodies, and station wagon on a 116-in. wheelbase chassis (up an inch over last year); the Olds "70," a Six with five body styles, of 120-in. wheelbase, the same as last year, and the Olds "90" Custom Eight Cruiser, which comes as a four-door touring sedan or as a club coupe. The eight-cylinder chassis has a wheelbase of 124 in., an increase of 4 in.

New die-cast radiator grilles and fender grilles, a new hood, and front fenders are characteristic of all models, which results in a certain family likeness. Sealed-beam headlights mounted flush in the front faces of the fenders are standard equipment, the parking lights being mounted under the headlamps in the fender-mounted grilles. Direction signals operating parking lamps and tail lamps, in pairs on each side, can be supplied at extra cost.

Overshadowing other features of the Olds line is the announcement of the Hydra-Matic drive, a completely automatic, hydraulic transmission, which will be offered as standard equipment on the "90," and will be available on all three series cars. For the first time in this country in recent years the public will be offered a car with a fully-automatic transmission, without friction clutch and clutch pedal. Despite its automaticity, the transmission is at all times under the control of the operator, through the medium of the shift lever, which has four positions, "Neutral," "Hi," "Lo" and "Reverse." Under all ordinary conditions the car can be started in "Hi," the transmission going through the gear changes automatically.

The new transmission incorporates a direct drive (fourth speed) which comes in automatically within a given speed range and is always in action when the car is traveling at more than 60 m.p.h. This protects

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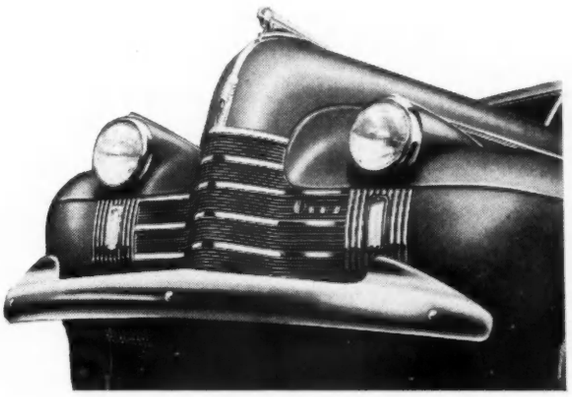
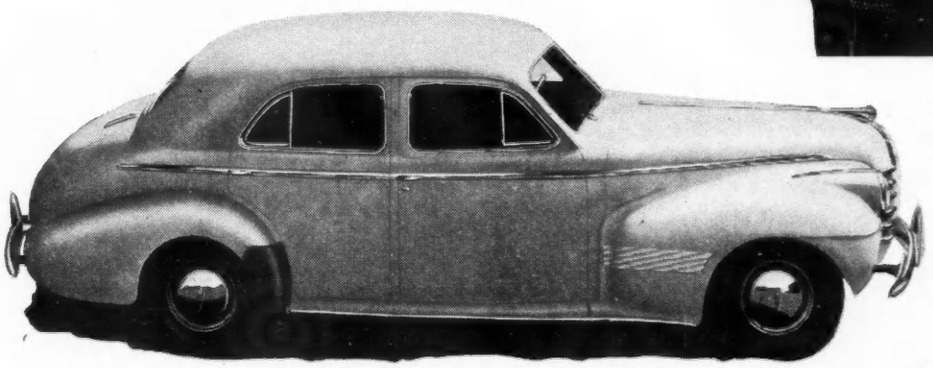
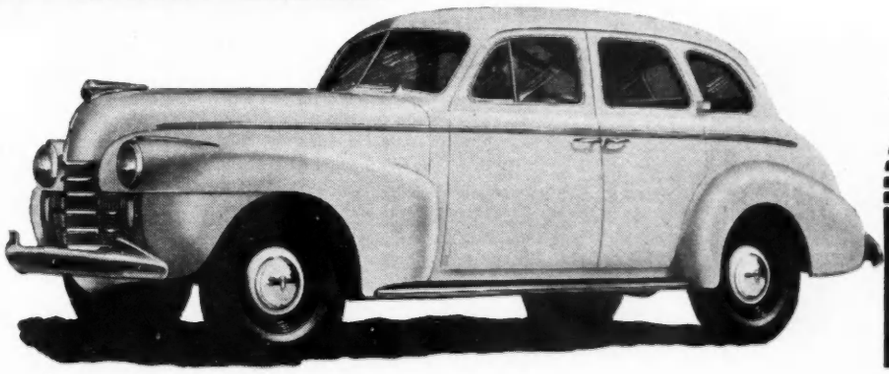


Front of the Oldsmobile line showing the new radiator and fender grilles





Above is a view of the Custom 8 Cruiser four-door touring sedan while at the right is the six-cylinder sedan model

Lap Gage Examination

Reveals

By P. E. FRIEND*

THREE devices have served in the past as a means of piston ring shape comparison and study, namely: the flexible band, the light gage, and the roller gage with its variations.

The first two represent earlier stages of the evolution of a study technique. The flexible band was used as a gage of circularity for determining the degree of "roundness" of piston rings. Use is still made of the flexible band device for this purpose. It consists essentially of a thin continuous metal band, within which a piston ring of proper diameter may be confined, and a means for determining the difference between the diameter across the rig gap and the diameter measured at 90 deg. from the gap, when the ring is so confined. This difference is expressed in thousandths of an inch. The length of the band is such that the ring confined within it is held compressed to specified gap or end clearance. Thus, although the ring is compressed to average diameter, equivalent to cylinder diameter, it is at the same time free to assume its natural shape because of the flexibility of the band.

The flexible band device is sometimes used in a form permitting easy adjustment to cover a range of diameters in the same band. A further modification, used at one time but to a very limited extent, was an attempt to more comprehensively chart ring shape by measuring diameters at multiple stations on the periphery of the ring.

The light gage device consists of a box, housing a source of light, from the top of which the light is emitted through a short, narrow slot. The ring to be studied is compressed into a short cylindrical steel gage accurately ground and lapped on the inside to true cylinder diameter. When the line of contact between periphery of the ring and the gage is passed over the light source, any deviation from "light-tightness" of the ring will be revealed.

But piston ring shape came to mean more than "light-tightness," and certainly measurements of free diameter cannot be a satisfactory means of shape analysis. The latter term is now understood to include the actual distribution of ring tension as radial pressure throughout the periphery of the closed ring.

To meet the need for a device that would afford a means of studying and comparing radial pressure distribution, the roller gage was developed. The roller gage is essentially a short cylindrical gage, lapped to

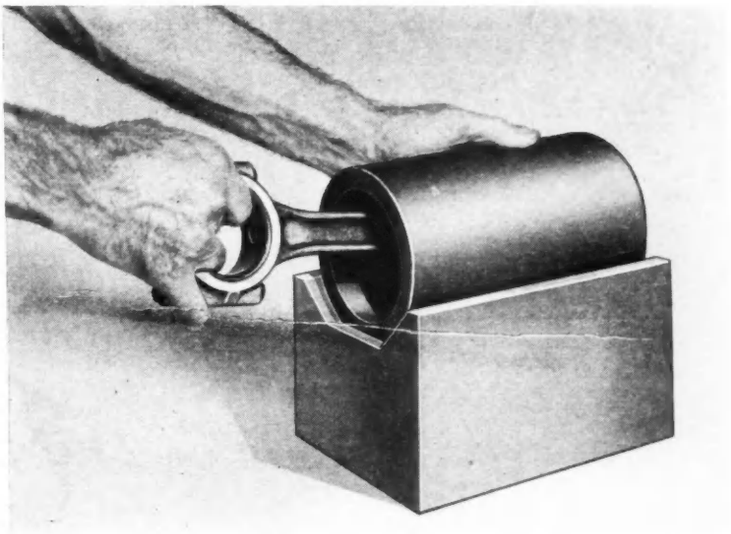
* Chief Engineer, Wilkening Mfg. Co., Philadelphia.

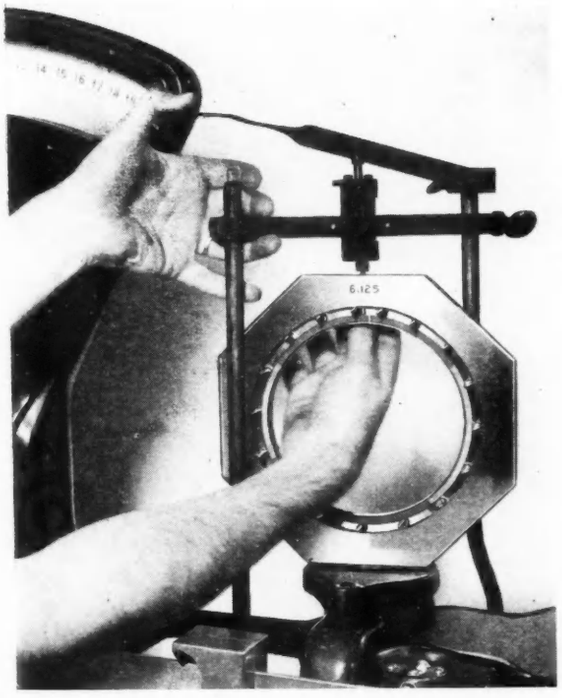
Above. Illustrating Constructon of Device for Checking Light-Tightness

Left. The Flexible Band Device for Measurement of Circularity

Importance of Piston Ring Accuracy

A minute dimensional variance in taper may be sufficient to unbalance forces in the ring and cause a twisting force that counteracts the beneficial effects of the taper itself





Above. Illustrating Lap Gage Construction

Left. Determination of Radial Pressure by Means of Roller Gage

true roundness on the inside surface. Held in place at spaced intervals around the inside circumference of the gage by a carrier plate is a series of frictionless rollers. Rollers are lapped smooth and round, each set being matched for diameter within twenty-five millionths of an inch. As many as 17 rollers or "stations" may be contained in a gage.

When a piston ring of proper diameter is confined within the circle of rollers, tension in the ring forces the rollers outwardly against the inner surface of the cylindrical gage. Thus each roller, one end of which is knurled for a finger grip, is held between the face of the ring and the gage surface by a force, the magnitude of which may vary on each roller or station in accordance with the piston ring radial pressure at each station. The radial pressures may be compared by "feel" of the frictional resistance which opposes turning the roller (with thumb and fore-finger) at each station. Various modifications of the roller gage have been developed, providing for exact determination of the magnitude of radial pressures. Although the roller gage is of undeniable value and usefulness in experimental and development work, comprehensive use of the gage, from the ring manufacturer's standpoint, must meet formidable opposition in the combination of high gage cost, plus the length of time required to observe the radial pressure on each ring. Of still greater importance is the fact that the roller gage is of doubtful value as even an indicator of ring shape and seating characteristics when dealing with the corner groove and taper face compression ring designs so popular today. Both are "dished" or twisted out of square with the cylinder wall by the unbalanced moment resulting in the ring section from the irregular cross section. The twist is not constant in any one ring, but varies continuously throughout the circumference from its minimum value at the gap to a maximum value at 180 deg. from the gap. It will be obvious that the roller gage is unreliable for use on any ring in which the normal balance of the force diagram has been disturbed.

(*Turn to page* 453, *please*)

Tractor Engine Filters,

ENGINE accessories and their effects on engine wear were the chief topics of discussion at the S.A.E. national tractor meeting held at Milwaukee on Sept. 28 and 29. The meeting was well attended—registrations passed the 400 mark—and a good deal of interest was shown in the various papers.

In addition to three technical sessions, the meeting included a dinner, at which the topic of the principal speaker also was a technical one, and a factory visit. A session of the Tractor and Industrial Power Equipment Activity Committee on Sept. 30 concluded the meeting.

During the past few years engine operators have been bothered a good deal by the formation of gum and lacquer on engine parts, and at the session devoted to oil filters the interesting assertion was made that a good filter properly applied will remove the gum-forming or lacquer-forming elements and prevent such trouble. The viscosity of these elements, it was stated, increase with temperature, whereas the oil becomes more fluid as its temperature rises, and at temperatures above 100 deg. Fahr., it becomes possible to filter the gum-forming elements out.

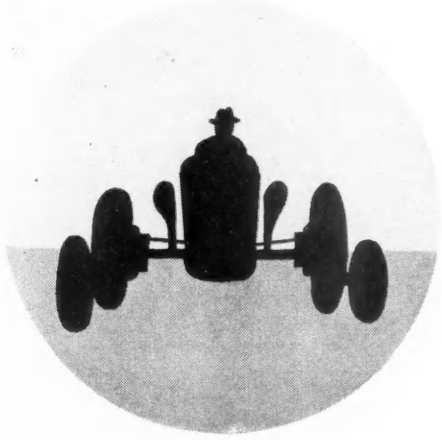
James E. Hurn, of De Luxe Products Corporation, La Porte, Ind., said many tractor manufacturers supply an oil *strainer* in their engines, instead of equipping them with a *filter*, evidently under the erroneous impression that in order to prevent engine wear it is only necessary to keep foreign matter out of the oil supply.

He said no full-flow oil filter will give protection when the oil is cold or when the filtering element has become partly coated, for which reason many consider a full-flow strainer necessary. If such a strainer is installed, it should consist of a fine screen of large area, on the inlet side of the oil pressure pump, or of a floating oil inlet with screen.

The condition of the oil filter when removed from the engine after a period of use is a good index of the lubrication and wear characteristics of the engine. If there are sludge accumulations in the filter, the latter does not meet the requirements so far as lubrication and reduction of engine wear are concerned. Either the filter is of insufficient capacity, or it is improperly applied. Excessive cylinder wear, ring wear, and even bearing failure are in most cases the result of incorrect lubrication.

It is the common practice to determine the lubricating value of an oil by tests showing the percentages of solids, carbon, and soluble materials, and the neutralization number. The author said this was not enough, and that the tests applied by his company included analyses for moisture, corrosive compounds, and asphaltenes, as these materials lead to the formation of sludge and lacquer, and therefore are directly responsible for engine wear. The oil filter should remove the asphaltenes, so that no sludge will be found in the engine or filter. If sludge and lacquer are allowed to build up, they deposit on the closely fitted parts of modern engines, and while not very hard, they are sufficiently hard to have an abrasive effect. Tests conducted by the author's firm in collaboration with a university laboratory proved conclusively, the author said, that a filter of adequate capacity, properly applied, will remove the asphaltic material so that lacquer cannot accumulate.

Although the greatest saving resulting from the use of efficient filtering equipment is in the reduction in maintenance cost, this is somewhat intangible and cannot be expressed in definite figures. Another saving, however, that due to the reduction in the amount of lubricant used, can be readily given in definite figures, and a number of examples were given in the paper.



The author summed up his arguments by saying he believed that filtering equipment that will maintain the lubricant in a satisfactory condition is of definite advantage to both the engine manufacturer and the operator; to the former because it will protect the reputation of his product, and to the latter because it will save him money.

L. W. Williams, chief engineer of Motor Improvements, Inc., Newark, N. J., in another paper read at the oil-filter session, traced the development of the automotive-type of oil filter historically. The earliest filters were of the filtering-cloth type, a cotton cloth

strainers and other accessories, discussed at the Milwaukee, SAE Tractor Meeting. Superfinish was among other subjects treated. Members visit local plants

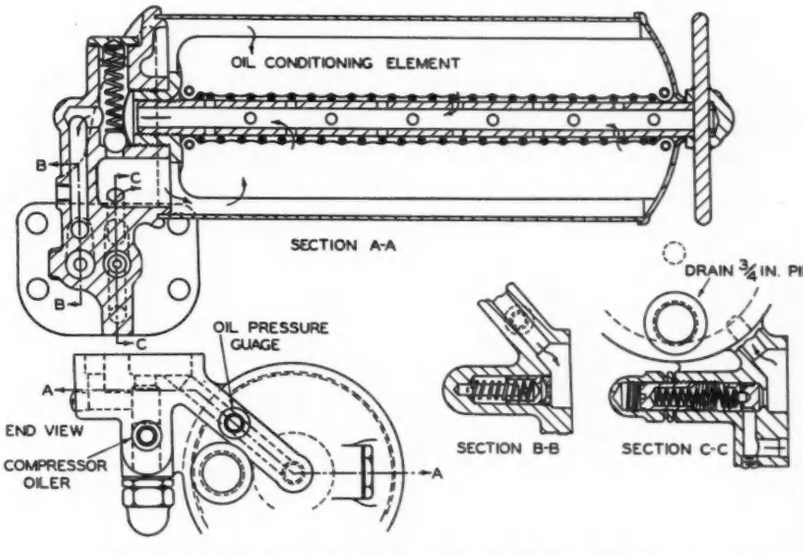
with a heavy nap on the dirty-oil side being used. Later it was found that a special grade of heavy wool fabric, sewed with silk, made a more durable filtering element. Still the necessity of comparatively frequent changes of the filtering elements, as well as frequent changes of crankcase oil, was a burden on the operator. This led to the development of the metal-edge type filter, in which the filtering element is finely spaced to catch and hold both abrasive matter and moisture. These filters were gradually enlarged and improved, until it was possible to build elements of the telescopic type, where one element is nested inside another, thereby increasing the area of the filter and reducing the velocity of the oil through it. These filters are so placed in the lubricating system that all of the oil fed to the main and rod bearings, to the timing gears and to the reciprocating parts, must pass first through the filter. The filter, of course, is equipped with the necessary relief valves and pressure-regulating valves to eliminate the possibility of failure in the lubricating system due to neglect of the operator to clean it.

Tractor manufacturers now are increasing the specific outputs of their engines still further; they want to increase the time between oil changes, and they are demanding filters that will keep the oil not only free from harmful abrasives, but also bright to the eye. To meet these more severe requirements, filter manufacturers have now developed extensive-area-and-depth-type filters and combinations of metal-edge-type line filters with absorption-type bleeder filters, which make it possible to extend the life of the lubricating oil in the crankcase from 60 hours (which formerly was the usual time between oil changes in tractor practice) to twice that length of time.

Charles A. Winslow in a paper on "Modern Methods of Conditioning Lubricating Oil During Use" also traced the development of automotive oil filters over a period of years and described a new, full-flow, in-line filter (illustrated by the accompanying drawings), for which he claimed that it will ensure a free flow of clean, filtered, and treated oil to the engine bearings, through novel, quick-change elements.

Although there is a by-pass around the filtering element, the system is claimed to differ basically from former part-time filters. For example, if the normal oil pressure at the bearings is, say, 60 lb., the by-pass valve may be set to 30 lb. Then, if the filter element has become clogged, the oil gage will register a pressure lower than normal, thus warning the operator that the filter element has reached the limit of its serviceability and should be renewed. Under no conditions can the oil pressure at the bearings drop below 30 lb.

The most important feature of this new filtering system is said to be that it not only traps impurities but *treats* the lubricant to enable it to resist the action the action of, and to trap out of circulation, corrosive materials, varnish, etc., as it passes through on its way to the engine bearings. In the author's opinion, the clean oil passing through the filtering element is a natural solvent for carbonaceous sludge-forming materials, varnish, rosin, gum, etc., which are added with each batch of new make-up oil. It was intimated that with this oil-conditioning system on the engine the oil sump need never be drained; that all that is necessary is to replenish the oil supply as it is used up. The system, it was claimed, eliminates the need for cleaning the pump screens and of taking the engine apart to remove carbon, varnish and sludge deposits. If oil is drained and renewed at intervals, as it always has been in the past, the average amount of solid contaminant, and of varnish and sludge is considerably greater than where the oil is conditioned continuously. The author concluded by saying it is obvious that reduction of engine wear and consequent saving on en-



Sectional view and details of the Winslow oil conditioner

TRACTORS

gine repair costs is also an important economy factor, aside from the fact that no (drained) oil is thrown away.

There was not much discussion on the oil-filter papers, but some of the oil men present thought that too much stress had been placed by the authors on the oil-economy factor. They held to the opinion that the best results would be obtained by the combination of a good filter with a good grade of lubricant renewed at suitable intervals.

Members Visit A. O. Smith Plant

Five bus loads of S.A.E. members and guests took part in the visit to the plant of the A. O. Smith Corporation, where they were interested particularly in the production processes employed in turning out automobile chassis frames. The plant has long had a reputation as one of the most highly mechanized in the automobile industry, and numerous kinds of mechanical handlings and other equipment are employed. Frames are assembled on a conveyor which moves forward stepwise from one station to the next. Rivets, instead of being inserted by hand, are "blown" in by compressed air. They are provided with fins on the shank so they cannot drop out again even if they are inserted from below. At each station there are riveting machines which, after the frame has arrived at the station, approach it from both sides, set a rivet each, and then recede, the whole operation being automatic. After being completely assembled, the frames are painted by spraying in a compartment through which they pass while hanging from an overhead conveyor, and they then pass on through a drying oven. Frames come off the line at the rate of six to eight per minute.

At the tractor dinner held at the Schroeder Hotel on Thursday evening, John S. Erskine, of the International Harvester Company, acted as chairman, and V. R. Jacobs, of the Goodyear Tire & Rubber Company, as toastmaster. David A. Wallace, president of Wallace Sales Division, Chrysler Corporation, gave a technical address on, and a demonstration of "Superfinish."

Fred M. Young, president of the Young Radiator Co. of Racine, presented a paper on "Temperature Control of Oil Used as a Lubricant and Coolant." He said there were many who agree on the desirability of internal cooling, but some contend that engine troubles thereby are transferred to the oil cooler. Mr. Young said that while this might hold true with certain types of design and installation, in his belief it was quite possible to make satisfactory, trouble-proof installations of oil coolers. As to the need for oil coolers, the author said too high oil temperatures may result in excessive oil consumption, bearing failures, excessive oxidation, or ring sticking. Certain difficulties with the lubricating system cannot be remedied by the installation of an oil cooler alone. For instance, if the underside of the piston runs excessively hot, then reducing the temperature of the crankcase oil from 300 to 150 deg. might result in only a slight reduction in oil-deterioration trouble. In a case of this kind it would be necessary to also increase the rate of circulation of the oil, in order that no portion of it may be raised to the temperature at which the oil breaks down. It is much more important to reduce the extreme temperature to which the oil is exposed than to reduce the crankcase temperature level. Incidentally, the increasing use of addition agents is more likely to succeed if the temperatures can be kept below the point at which these addition agents disintegrate.

When oil is spread in a very fine film on cylinder walls, there is a tendency to form iron naphthenate, the accelerator used in the manufacture of lacquer. Mr. Young said he had seen a number of engines run the equivalent of 5000 miles at 50 m.p.h. without a change of oil. In these engines the pistons, skirts, wrist pins, and crankshaft journal surfaces were covered with lacquer or oxidation varnish just as if some one had painted them with a brush. Frequent oil changes seem to reduce lacquer trouble, but it alone cannot achieve the desired results.

Considerable trouble from oil deterioration has been experienced with certain types of compression-ignition engines. The author expressed the belief that complete freedom from this trouble could be had by spray-cooling the piston, instead of relying entirely on heat transfer through the oil film between piston and cylinder. Actual tests have shown that ring-sticking troubles and excessive oxidation of lubricating oil can be avoided, and such an internal cooling system incorporating an oil cooler is well worth the cost. The table below gives test data from an engine equipped with such a cooling system.

Heat Rejection to Jackets and Lubricating Oil in Two-stroke 4¼ by 5-in. Engine

R.P.M.	Oil Gallery Pressure Lb./sq. in.	Oil Flow to Each Piston-G.P.M.	Oil Sump Temp., Deg. F.	BTU/Bhp/min. to oil 160 Deg. Water Full load	BTU/min/HP Total to Water and Oil
800	23	0.26	178	2.9	42.5
1000	26	0.44	181	4.07	40
1200	28	0.65	184	5.22	36
1400	29	0.67	186	5.17	34.5
1600	31	0.79	190	4.92	34
1800	32.5	0.86	196	6.03	35
2000	34	1.02	200	6.18	36.5

From this table it will be seen that at 2000 r.p.m. the heat rejected to the oil is equal to 17 per cent of that rejected to the oil and water together. In power units with this type of cooling system the oil cooler is located in the stamped bottom tank of the radiator and made an integral part of it. In the stamped brass bottom tank is fitted a group of seamless copper hair-pin-shaped tubes connected in parallel. Each of the tubes has a specially shaped breaking strip or agitator inserted into it at the time of assembly. This is claimed to result in both high efficiency and great strength. Locating the oil cooler in the bottom tank of the radiator makes for clean appearance and places the unit in a position where it is protected against injury.

In connection with his paper Mr. Young showed numerous slides illustrating different designs of oil coolers, some of them intended for aircraft use. He explained that if it is desired to cool the oil to a temperature below that of the cooling water, an air-type

cooler must be used, the minimum temperature to which the oil can be cooled by a water-type cooler being about 20 deg. above the water temperature.

Oil coolers must be selected large enough in capacity so that they will continuously furnish sufficient cooling regardless of the condition of the heat-transfer surfaces. If no means of periodic cleaning is provided, the transfer surface should be approximately 35 per cent greater than needed when new, to take care of the loss in efficiency when the surfaces are coated with sludge. Likewise, oil passages should be selected which are large enough so that there will be no plugging or stoppage of oil flow.

A paper by F. L. Miller and W. C. Winning of Standard Oil Development Company, on "Some Factors Affecting Wear in Heavy-Duty Engines," was read by Doctor Miller. It was based to a considerable extent on results which have been published in earlier issues of AUTOMOTIVE INDUSTRIES, such as those of C. G. Williams of the Institution of Automobile Engineers.

A paper on bearing seals for tractors was presented by R. J. Vedovell, vice-president of Chicago Rawhide Mfg. Co., of which the following is an abstract:

About 12 years ago the urgent need for better sealing methods for bearings resulted in the development of the self-contained, press-fitting spring-loaded seal having a flexible leather sealing member that does not score the shaft. Since that time many improvements have been made in these seals, as a result of field experience and further research.

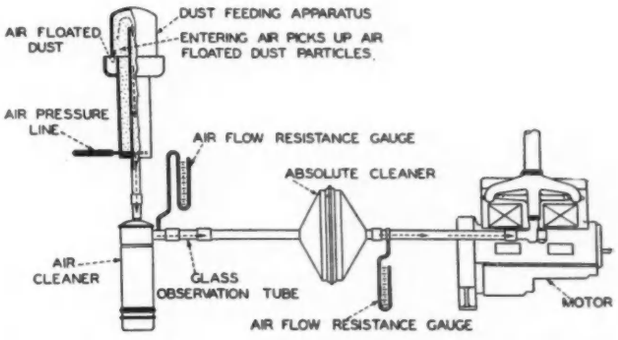
A seal of this type generally has a packing member made of suitably tanned leather. The barrel of the flange is tapered, so as to give very limited but sufficient shaft contact, with a sharp wiping edge to cut the film of oil as it approaches the seal. This reduces friction and power loss, and eliminates the possibility of damage to the packing member and shaft. A treatment for the leather has been developed which restricts seepage of lubricant through it, but permits sufficient seepage to properly lubricate the contact surfaces.

Spring-tension charts have been compiled and give the pressures required for various shaft speeds and operating conditions. The packing member is so designed that the spring is located at the lip or wiping edge.

The sealing member must be held securely in the cup stamping to eliminate leakage on the outer periphery, and must be held rigid to eliminate rotation. This is accomplished by the inner shell member, which is clamped down tightly on the leather sealing member and contains prongs which are imbedded in the packing. The notch-and-prong features of the inner shell and cover washer lock the entire assembly. Outside diameters are held to a close tolerance to insure against excessive press fits, which might cause distortion of the internal parts and leakage between the housing bore and the circumference of the seal. This is accomplished by grinding the outer cup stamping.

In a series of lantern slides accompanying the paper the author showed numerous applications of these seals in tractor design.

A proposed air cleaner test code was presented for the Air-Cleaner Test-Code Sub-Committee by W. H. Worthington, research engineer of the John Deere Tractor Co.



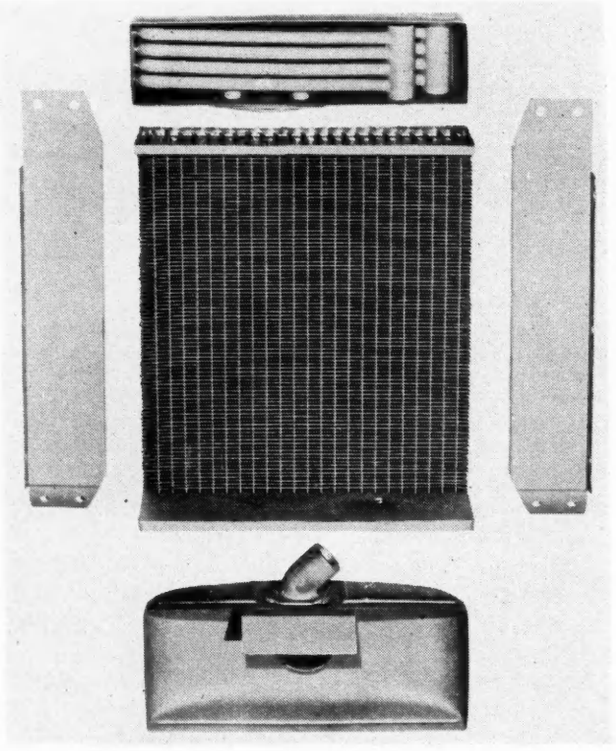
Air-cleaner and test setup described by W. H. Worthington

The procedure is intended for laboratory use in determining the operating characteristics of air cleaners in their application to engines of the internal-combustion type and includes the following:

1. Cleaner capacity determination (preliminary oil carry-over).
2. Determination of the highest oil level at which the cleaner will operate without oil loss.
3. Determination of the lowest level at which satisfactory oil action is maintained.
4. Determination of cleaner resistance and horsepower loss.
   a. With cleaner clean
   b. With cleaner fouled (see Item 8 below)
5. Determination of cleaner efficiency at a selected operating level using SAE 40 oil (at governed engine speed and full load).
6. Determination of cleaner efficiency at the lowest-allowable oil level with SAE 40 oil (at governed speed and no load).
7. Back-fire test (check for effectiveness of back-fire arrangement).
8. Dust capacity test (maximum amount of dust that cleaner will hold and still give satisfactory performance).
9. Chaff and plug-up test (to determine behavior of cleaner under conditions when chaff or lint is collected).

Two of the most important items of the equipment required for the test are the dust-feeding apparatus and the absolute cleaner. The dust-feeding apparatus feeds dust by air floatations. Air is fed into the feeding apparatus after having been passed through a suitable air dryer, since moisture contacting the dust causes caking and coagulation. To prevent the accumulation of surface dust on the inside of the dust chamber, which spells off and enters the air stream in flakes, the dust chamber should be provided with a vibrator.

Cloths for the absolute cleaner are to be cut to size from 10-oz. Canton flannel, Moleskin, or felt weighing not less than 1½ lb. per sq. yd. New cloths are to be laundered before use. The fuzzy side of Moleskin or flannel is to be toward air flow. The absolute cleaner must be of such a size that the restriction resulting from the collection of dust on the cleaner cloths will not affect engine operation.



Oil cooler developed by the Young Radiator Co. The bottom section which is the tank contains the oil cooler.

A diagram of the test apparatus is shown herewith.

The efficiency of the cleaner is to be determined by the formula

$$\text{Efficiency } (\%) = 100 \left(1 - \frac{\text{Increase in weight of absolute cleaner cloths}}{\text{Total weight of dust fed}}\right)$$

and the result arrived at is to be checked by the formula

$$\text{Efficiency } (\%) = 100 \times \frac{\text{Change in cleaner weight}}{\text{Total weight of dust fed}}$$

and by the formula "Increase in weight of absolute cleaner plus increase in weight of cleaner equals weight of dust fed."

J. B. Fisher of Waukesha Motor Co. spoke on "Accelerated Wear Tests," that is, the wear tests conducted in the Waukesha "dust house." He referred to the different kinds of wear, such as abrasive wear and corrosive wear, and mentioned that in England austenitic iron was used to combat corrosive wear. Some manufacturers put a small ring of this iron in the cylinder at the upper end of the stroke, which practically eliminates such wear. Mr. Fisher had a good word for hard chromium plating, which not only greatly reduces bore wear, but also cuts down the wear of the piston rings to a marked extent; but he expressed doubt whether engine buyers were willing to pay for the chromium plating.

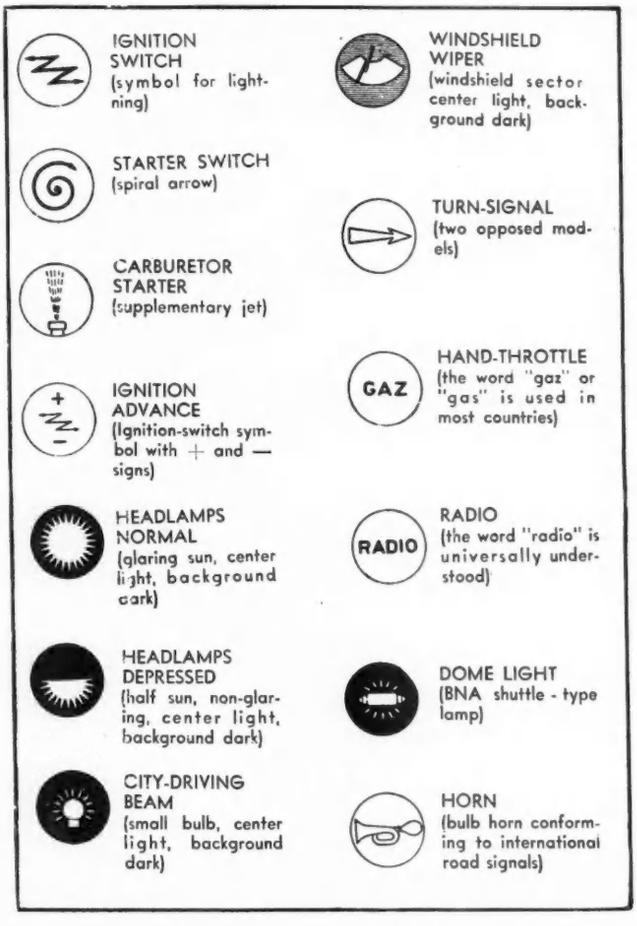
Wear is most rapid when the engine is cold, and with a sub-zero solution in the water jacket it is possible to get as rapid wear under otherwise normal conditions as at normal temperatures in the dust house. One automobile manufacturer, the speaker said, had made the statement that 90 per cent of all cylinder wear took place during the starting period.

Gear and Chain Drive

A PATENT has been issued in England to the Triumph Engineering Co., Ltd., of Coventry on a combined gear and chain drive for the camshaft and accessories-drive shafts of an internal-combustion engine. There is first a reduction of substantially 2:1 by a pinion on the crankshaft meshing with an internal gear. The internal gear carries sprocket teeth on its outer circumference, and a driving chain runs over this sprocket and over sprockets on the camshaft and the accessories drive shaft. The advantage apparently is that all three sprockets can be of substantially the same size, which makes the drive more compact.

Standardized Symbols

Symbols for automobile controls have been standardized by the French Standards Office (Bureau des Normes). As far as possible, these symbols were so chosen that they would be readily understood in different countries. The capital letters usually employed to designate the function of the different controls are not sufficiently readable, especially when there are a large number of such controls, and, besides, if the car is exported to a country in which a different language is spoken, these inscriptions no longer convey the intended meaning. The symbols adopted for the various control buttons are illustrated herewith.


IGNITION SWITCH (symbol for lightning)
STARTER SWITCH (spiral arrow)
CARBURETOR STARTER (supplementary jet)
IGNITION ADVANCE (Ignition-switch symbol with + and — signs)
HEADLAMPS NORMAL (glaring sun, center light, background dark)
HEADLAMPS DEPRESSED (half sun, non-glaring, center light, background dark)
CITY-DRIVING BEAM (small bulb, center light, background dark)
WINDSHIELD WIPER (windshield sector center light, background dark)
TURN-SIGNAL (two opposed models)
GAZ
HAND-THROTTLE (the word "gaz" or "gas" is used in most countries)
RADIO
RADIO (the word "radio" is universally understood)
DOME LIGHT (BNA shuttle - type lamp)
HORN (bulb horn conforming to international road signals)

Chevrolet is Longer for '40

(*Continued from page* 437)

duce the rotating weight. The disk has radially slotted facings, which assure easier release, offsetting the extreme gripping action of full lining contact.

A new generator with a maximum charging rate of 33 amp. is carried on all series; it has full voltage-current regulation. The battery has the same rating (100 amp. hr.) but is shorter and higher, to fit the new under-hood mounting, in a metal tray over the right-hand side rail.

Frames are of the same box-girder design, but changed to take care of the increased wheelbase and wider body. The frame for the Master 85 is the same, except for the differences at suspension points. Between front and rear kick-ups, the top of the frame is about 2¾ in. lower. In addition, the frame is widened from the front of the dash to the rear, where it is 2 in. wider. The front cross member is revised to elevate the engine mounting. The second cross member is of box-section, with box-section braces extending forward from this cross member and fastening to the side rails. Short brackets from these braces replace the former engine side-support tie-bar. Outrigger body brackets are used to take care of the wider body, and step hangers are eliminated, since the running boards now are attached to the body sills.

Front suspension remains substantially the same, so far as knee action is concerned, except that the spring rate has been increased from 106 to 111 lb. per in., to compensate for the redistribution of weight. The upper bearing of the front stabilizer shaft now is separate and does not support the bumper back bar.

On the Master 85, the front spring is now shackled at the front to improve the steering geometry. The rear end of the front spring has a reinforced Berlin eye. Front shock absorbers are the same as before, but the mounting has been changed to give diagonal bracing. An auxiliary rubber spring bumper is fitted to the under side of the side rail, between the regular bumper and the rear hanger.

Rear suspension on all models has been changed by the adoption of a tension-type shackle which is designed to produce a variable-spring-rate effect. While the spring length remains the same, the spring has an overhung type of rear eye. The front eye bushing is of rubber, as before, but the rear eye is fitted with a threaded steel bushing. The spring slope is increased slightly by raising the rear and lowering the front eye. On both de luxe models spring covers are provided as before, and the shock absorbers remain practically unchanged. The same improvements in rear suspension are found on the Master 85, which, however, has shock absorbers of the single-acting type, and no spring covers.

On the Master 85 a simple steel pitman arm replaces the rubber-insulated arm. The drag link is straight and shorter. The steering gear is mounted on the side rail, farther forward, while the worm is underslung.

The brake master cylinder is mounted on the left brace from the second cross member to the side rail, farther forward than previously. Openings with spring snap covers now are found on front and rear brake flanges, to facilitate adjustment without removing the wheels.

On the two higher-priced series the gear ratio has been changed from 4.222 to 4.111, to improve the fuel economy.

The propeller shaft remains the same, except for a slight increase in length and diameter. The front bushing has been lengthened to increase its bearing area. A fully enclosed needle-bearing universal joint is used.

The fuel-tank capacity has been increased from 14 to 16 gallons, except on the business coupe, where an 18-gal. tank is slung under the body amidships. A three-point rubber mounting replaces the strap mounting.

Marked changes have been made in the transmission, helical low-speed and reverse gears replacing the spur gears formerly used. In addition, the synchronizers are fitted with two lugs instead of three. The shifting mechanism has been moved to the left side of the case, to permit lowering the floor. The vacuum shifting mechanism has been simplified and made more direct-acting, and its parts are better sealed. The mechanism can be readily serviced without removing it from the transmission. For the inspection of gears, it can be removed from the case as a unit. The case has been lengthened at the rear to make up for the increased wheelbase. The vacuum-cylinder-support bracket is now an integral stamping with the ball-joint collar.

The new body is of Fisher Unisteel construction, with turret top, and is longer and wider. It features longitudinal box-section sills; a stronger steel-floor construction, box-section roof rails, and a unique cowl design. The latter comprises a one-piece dash and toe-pan, which incorporates large support anchors from cowl to side rails. Box-section braces from the door pillars extend to this support and to the dash.

The bodies are fitted with safety plate glass all around, the new high-test safety plate being used in windshields of all series and in side windows of some models. The rear window is a single piece of curved tempered glass except in station wagons and the new cabriolet.

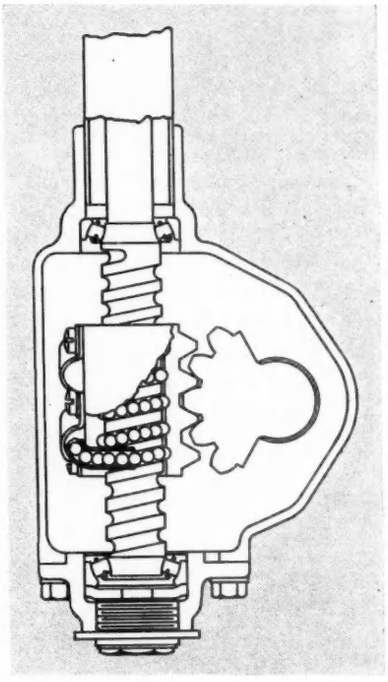
A NEW machine has been installed recently in the National Physical Laboratory, Teddington, England, for testing the reference jets used by manufacturers for testing carburetor jets. The new machine has a capacity of up to 10,000 ml. (2.65 gals.) per second.

Cadillac Blankets Field

(*Continued from page* 433)

(431 cu. in. displacement), rated 185 hp. at 3600 r.p.m., with a compression ratio of 6.75. This engine is continued without change.

As regards chassis details, the LaSalles and Series 62 have longer wheelbases, new frames, and revised front- and rear-suspension systems. The Series 72 chassis is entirely new, while other models are continued with detail changes. Heavier stock is used for the frames on the LaSalles and Series 62, and frame weight is kept down by reducing the depth of the side rails by approximately 1 in. On the Cadillac 75 and the Sixteen the X-members are of channel section as



Ball-bearing worm and nut gear used in the Fleetwood 72 steering case

Cadillac and LaSalle bodies this year offer appreciably increased comfort through the design of new seat cushions and backs. Folding rear arm rests are standard. This is the LaSalle Special touring sedan.

in the past, whereas in the other series they are of the three-piece welded I-beam design, with arms extending farther forward.

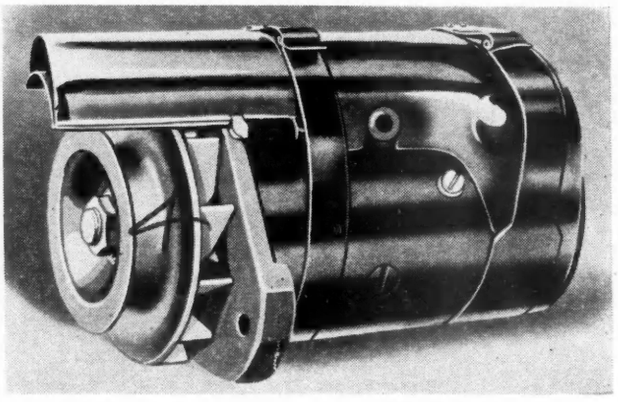
The same chassis suspension system that has been used on the 60-S has now been applied also to the LaSalles and the Series 62, and is said to improve the low-speed ride. Rear springs have a lower rate and are assembled with interleaf liners with protective felt covers over the two longest liners. The cross link rear stabilizer now is used on all models. Front-spring suspension has been changed by the adoption of threaded inner bushings with rubber seals and heavier knuckle supports.

Steering of the Sixty Special has been further improved by employing a heavier front stabilizer.

An entirely new steering gear—the ball-bearing worm-and-nut gear—is offered for the first time on the Series 72. Friction is greatly reduced by the anti-friction action of a large number of balls which roll between the worm and nut. These balls are constrained to move within a closed circuit by means of two ball return chambers connecting the ends and the center of the worm.

Easier shifting is effected by increasing the leverage of the shifting levers. The interlock, introduced last year, is continued. A new feature of the transmission control assembly is the improved method of fixing the relationship between the shifter shaft and tube.

The terneplate construction of the '39 muffler has been continued with a few detail changes in the corrosion-resistant outer shell. All are inside changes, so that the '39 and '40 mufflers are interchangeable.



An air scoop at the side of the 1940 Cadillac and LaSalle generators is one of the design changes making possible an increased charging rate to 34 amperes. Located back of the fan, the scoop is an aid to cooling.

A tuning chamber has been added to the inlet pipe, similar to that on the outlet pipe.

A new body, distinctively styled, is found on the Series 52 and 62. Doors open from the rear, and there are locks in both front doors. All door hinges are concealed. As on the Series 50, running boards are optional and may be added or removed in the field. Windows are wide and outlined by chrome reveals. The large rear window is in a single piece of curved glass that conforms with the body outline.

The body is of Unisteel construction with turret top, inproved to give greater strength and rigidity. It has a one-piece cowl and toe-board construction, and an exceptionally strong cowl side design consisting of a straight line structural support extending from the front body bracket to the windshield pillar. The wide body is given added support on the chassis by four outboard body braces, two on each side, extending to the outer portion of the sill.

Hoods open from the front, as before, and are held by a safety automatic latch. On the Model 52 there are two hood supports, instead of a single one as on the 50.

Rear-door safety locks, controlled by a button projecting through the garnish molding for Series 50, and by a lever on the door panel for Series 52, 62, and 72 is a feature of the new Fisher body four-door sedans and the 60-S model. Both the inner and outer door handles are permitted to free-wheel until the lock is released. Sunshine turret tops are available on the 5-passenger touring sedan and 5-passenger touring coupe; at extra cost on the LaSalle 50 and the 60-S 5-passenger touring sedan.

With the exception of the 90, which remains unchanged, all Cadillac series feature new front-end treatment with new radiator grilles, long streamlined headlamps, and fender lamps. The Cadillac Series 62 has the same body as the Series 52 and the same distinctive constructional and mounting details.

Cadillac 72 is introduced to meet the demand for a large, luxurious car priced below the Series 75. It is available in the sedan and Imperial body models, styled less conservatively than the 75. Bodies are of all-steel construction with turret top, built by Fleetwood, and incorporate the rigid cowl construction and other features of the Series 52 and 62 body.

Provision is made for the installation of one or the other of the following two car-heating systems.

1. Conventional dash-mounted heater available in both ventilating and non-ventilating types, with windshield defroster and three-speed, reversible motor.

2. Under-seat hot-water heater, consisting of two separate units, one under each seat, supplemented with an independent defroster and ventilating unit.

Use of two of the large-capacity under-seat heaters ensures uniform heating of front and rear compartments. Each heater can be regulated or turned on and off separately. A defroster and ventilating unit, regulated by separate controls, is mounted on the dash. Cool, fresh air may be drawn in at will while the heaters are in operation.

Provision for the installation of under-seat heaters is made in all closed sedan bodies. In the Fleetwood bodies the necessary ducts and registers are standard equipment.

Pontiac Makes Strong Bid for 1940

(*Continued from page* 435)

selection. This further reduces the gear-shifting effort required. A detail change in the transmission is the relieving of the sides of the second and high-speed notches in the shift rail toward the neutral position. This makes it easier to shift out of gear. The shifting effort required has been further cut down by reducing the ball-spring tension from 12 to 8 lb. Roller bearings replace the bronze bushings on the transmission counter shaft.

The capacity of the generators has been increased to 37 amperes at 30 m.p.h. Full voltage-current regulation is standard on all models.

The frames for both the 40-25 and 40-29 are entirely new, as these models have a longer wheelbase and new, wider bodies. However, such basic features of Pontiac design as straight X-members, side rails of box-girder section forward of the dash, and box-girder front cross members, are retained. The frames for the 40-26 and 40-28 remain unchanged.

The bushings on the knuckle pins now float, having both outer and inner bearing surfaces. The seat diameter for the inner wheel bearing has been increased 3/32 in. and the new bearing is interchangeable with similar bearings on other G.M. cars.

Series 26 and 28 models, with running board aprons, are provided with a shallow, triangular molded-rubber front-fender stone shield, attached to the lower rear edge of the front fender.

The hypoid rear axle is continued without change, except that the gear ratio is now 4.3 on all models. In production, the bearing surface for the rear-axle pinion rear bearing is Superfinished.

Tires are 16 by 6.00 on the Series 25 and 26, and 16 by 6.50 on the Series 28 and 29. Series 25 has a new body designed for greater comfort and safety, with the floor at the door opening 4 in. lower than formerly, and 4 in. added to the width of the front seat. The depth of the windshield has been increased 1 in.

New body features include chrome-trimming of the windshield, a convenient front-seat adjustment at the left of the cushion, new High-Test safety plate glass, a new Continental-Walnut finish instrument board featuring a chrome-trimmed radio grille, new instruments, and clearance under the front cushion for the installation of an under-seat heater which is sold as an extra.

With minor changes the DeLuxe bodies on the Series

26 and 28 are continued for 1940. Improvements include new High-Test safety plate glass, a new instrument board, and garnish moldings in Continental-Walnut finish, chrome-rimmed plastic inside-hardware ferrules, a more convenient front seat adjustment, clearance under the front seat for the under-seat heater, and a level floor in the business-coupe decks. The steering wheel, column, brake lever, gearshift lever and horn button on these and all other body models are finished in sandalwood beige.

The most striking offering is the new body available on the Series 40-29. The front seat is 5 in. wider than on the DeLuxe line; the rear seat, 1 in. wider. An upholstered armrest in the center of the rear seat folds neatly into the back cushion when not in use. A windshield 2½ in. wider than the DeLuxe shield assures good vision from any position on the wider front seat. An increase of 2¼ in. in the width of the rear window assures equally good vision to the rear. Floors are of the same height as in the DeLuxe models.

The four-door model has two side windows, and these, the same as the windshield and rear window, are framed by exterior chrome moldings. Extra-wide rear doors are hinged at the front, opening well back into the cushion and affording easy entrance and exit. A slightly curved rear-window glass lends distinction to the rear view. The spare tire on both models lays flat on the trunk floor. Other improvements include new High-Test safety-plate glass, concealed door hinges, a more convenient, front-seat adjustment, a new inside door-lock lever, and outside door locks on both right and left doors. Extending completely across the body, the sport-coupe auxiliary-seat cushion measures 58½ in. from arm rest to arm rest.

Customers are given options on both the conventional hot-water heater, dash-mounted, and a new under-seat heater. Both systems may be supplemented by a defroster and a fresh-air intake. The under-seat heater is of the hot water type but has about 50 per cent more heating capacity than the Master dash heater, and about 20 per cent more than the DeLuxe dash heater. It heats the front and rear substantially equally.

Estimated curb weights range from 3195 to 3300 lb. in the 40-25 series, from 3235 to 3340 lb. in the 40-26 series, from 3325 to 3430 lb. in the 40-28 series and from 3545 to 3635 lb. in the 40-29 series. The 40-25 chassis has a wheelbase of 117 in.; the 40-26 and 40-28 have wheelbases of 120 in., and the 40-29 has a wheelbase of 122 in. All series have a front tread of 58 and a rear tread of 59 in.

Oldsmobile for 1940

(Continued from page 441)

the engine. The unit also has the important "kick-down" feature, which makes it possible to shift from fourth to third at any speed below 60 m.p.h. by simply jamming the accelerator pedal to the floor board.

All-steel bodies with turret top feature the use of Hi-Test safety plate glass. The new bodies on the "60" and "90" have lower floors and lower roofs, the "torpedo" body on the "90" being offered without running boards. All Olds bodies are "Bonderized" and finished with five coats of lacquer.

Engines remain practically unchanged, except for details, the most important development being that the same engine is now being used on both the "60" and "70," the smaller six-cylinder engine of last year's line having been discontinued. This year's six-cylinder is an L-head engine of 3 7/16-in. bore by 4⅛-in. stroke (230 cu. in. displacement), rated 95 hp. at 3300 r.p.m., with a cast-iron head and 6.1 compression ratio. On the "60" this represents an increase of 5 hp.

The "90" engine is an eight-cylinder, L-head of 3¼-in. bore by 3⅞-in. stroke (257 cu. in. displacement), rated 110 hp. at 3500 r.p.m., with 6.2 compression ratio and cast-iron head.

Both engines continue the use of anodized aluminum-alloy pistons with four rings. Vacuum spark advance has been added on the Six. Adoption of the sealed-beam headlamps has been followed by the use of a new shunt-type generator rated 33 amp. when hot, and 35-37 amp. normal. Full automatic voltage-current regulation is standard equipment. The under-hood battery is continued, but is now provided with a one-piece sealing cover.

So far as general chassis features are concerned, Olds is continuing its major design elements, such as coil springs at all four corners, four-way stabilization, etc., with only detail changes. Frames feature the use of channel section X-members, with detail changes on the "60" and "90."

Olds also provides a special frame for convertible coupe models, with heavier structural members plus heavy steel plate reinforcements at the X-members.

Brakes are 11 by 1¾ in. on the Sixes, 11 by 2 in. on the "90"; tires, 16/6.00 on the "60"; 16/6.50 on the "70," 15/7.00 on the "90."

The column-mounted shift lever has full mechanical linkage to the transmission.

Rear axles remain unchanged, with a 4.1 standard and 4.555 optional ratio on the "60"; 4.3 standard and 4.555 optional on the "70," and 3.646 standard on the "90."

Much attention has been devoted to the problem of propeller shafts. The number of different lengths in the line has been reduced, and the shafts are kept as short as possible in order to prevent vibration. Rear-bearing extensions of suitable length on the synchro-mesh transmissions permit of using propeller shafts of the same length whether a car is equipped with the conventional or the automatic transmission. In this way a degree of interchangeability is achieved, and the number of different shaft lengths in production is reduced.

Seat cushions of both front and rear seats are of special design. On the "90" the seats have foam-rubber padding over the conventional coil-spring base.

Lap Gage Examination

(*Continued from page* 443)

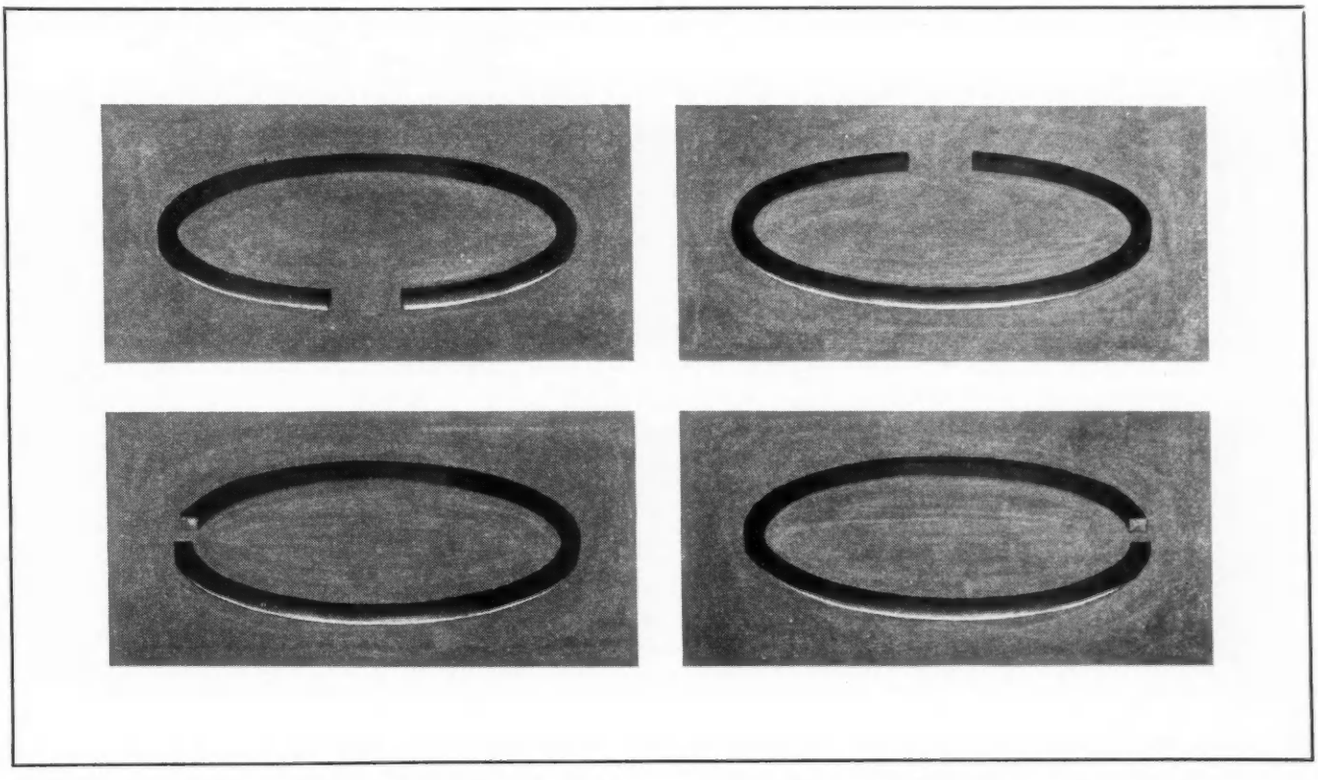
In order to circumvent the delinquencies of the roller gage in this respect, we make use of a lap gage which consists of a cast iron cylinder, and a closely fitting piston with connecting rod attached. The inside surface of the cylinder is converted into a lap by the evenly distributed impregnation of diamond particles. The rings to be studied are snapped into the piston grooves and are given from one to four strokes in the cylinder. The exact nature of the ring contact with the cylinder wall can then be observed visually.

High pressure and low pressure spots, if present, are clearly discernible as variations in the intensity of the lapping action. This picture, of course, embraces the entire circumference of the ring rather than a limited number of points, as in the case of the roller gage. The reduction in the time factor involved in the practical study of ring shape can be readily appreciated.

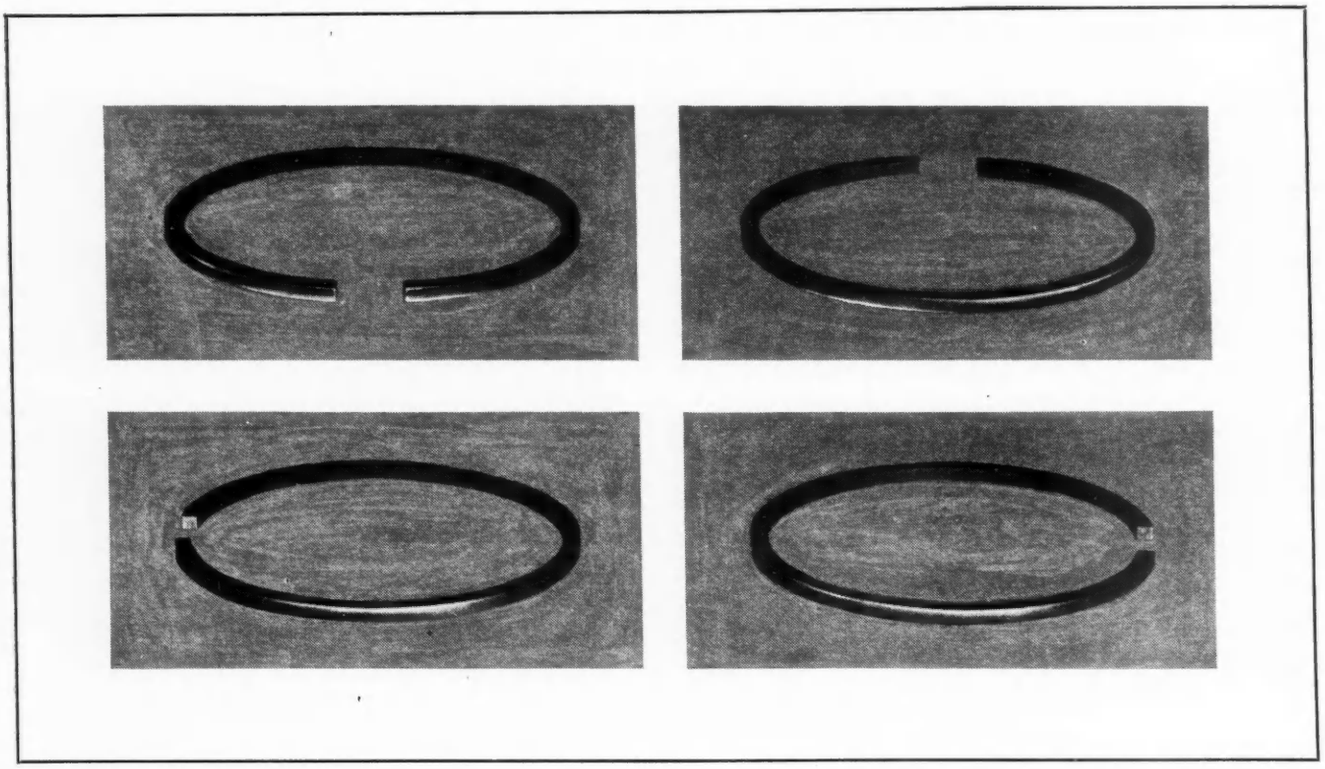
But the lap gage offers further new advantages to the observer interested in piston ring shape. By means of the device the seating pattern of a twisted or "dished" ring may be readily traced, supplying a means of determining the uniformity of the twist and seating of such rings.

It is not generally know that even conventional straight-face compression and oil rings will twist from the influence of both the inherent casting strains and the ordinary machining operations, if care is not taken in their manufacture to eliminate such strains or their effect by suitable treatment or machining. By its nature, such twist is "uncontrolled," and may show up on the ring after lapping as an irregular line of bearing, crossing and recrossing from one side of the ring face to the other, showing low pressure at each cross-over area. Or, in other instances, the bearing surface may be almost wholly on one side of the ring face. Such engine production problems as prolonged "break-in" periods, inconsistent oil consumption, or high oil consumption and blowby may be traced to "uncontrolled" twist in rings.

Taper face compression rings have been resorted to by several manufacturers as a means of securing immediate break-in and oil control. The desired feature of taper face rings, which influences their choice over intentionally dished designs such as the corner



A Taper Face Compression ring that has been put through the lap gage. Four views are shown, taken 90 deg. apart around the periphery. This ring shows the preferred uniform bearing completely around the periphery of the ring, appearing in the photo as a white band along the bottom edge of the ring face. The uniformity in width of this band indicates both accuracy in the taper dimension and absence of undesirable twist in the ring. Variation in dimension and twist would show up in the lap gage as a variation in width and intensity of the contact or bearing area. The width of the bearing area (the white band in the photo) may vary in a single ring from zero (showing no contact) to the full width of the ring face.



A Straight Face Compression ring revealing the "cross-over" seating characteristics of a ring irregularly twisted by improper side grinding. This ring embodies strains which produce a series of directional reversals of the unbalanced moment throughout the periphery of the ring. Thus, the white band of contact alternates from one side to the other instead of seating squarely across the full face, as it should.

grooved rings, is uniform seating. Merely tapering the face of the compression rings a predetermined amount will yield more uniform seating against the cylinder wall than will the corner grooved rings in which the amount of dish or twist varies widely throughout each ring. Contrary to wide belief the operation of tapering the piston ring face does not necessarily counteract the effects of undesirable strains or inaccuracies existing in the rings.

The application of the lap gage in this instance reveals some very interesting facts, the study of which has led to success in the production of the rings with uniform accuracy. To begin with, even the small taper dimension usually specified, 0.0005 to 0.001 in. difference in the radial thickness dimension between the top and bottom of the ring, is sufficient to unbalance the forces in the ring and to cause an appreciable twist. This twisting force works in a direction to counteract the taper. By analyzing the effects of the twist, and adopting compensatory manufacturing technique, its extent can be controlled to a maximum of 0.0004 in. By merely pursuing a normal manufacturing procedure, however, the dish is commonly found to be more on the order of 0.0006 to 0.0008 in. In view of this important effect of the tapering operation on unbalancing the ring section, the necessity of holding the amount of taper within close tolerances is readily appreciated. The combined effects of the tapering operation itself, with the variation in the degree of taper, and with any natural irregularities in ring shape and flatness which are allowed to persist in the finished product, produce an irregularity in seating that is strikingly revealed when the rings are put through the lapping test. One is quite likely to find an actual seating variation around the ring, extending all the way from areas showing no bearing at all to other areas where the ring is contacting across the full face, even though the same ring in the open position is in compliance with the taper specifications at all points when checked on the taper gage.

These facts are brought out, not in condemnation of any particular ring design, but rather to illustrate an important application of the lap gage device as a practical check on the accuracy with which the actual ring production consummates the theoretical design. The lap gage has served to explain some of the unexpected inconsistencies in results on production engines. Because of a knowledge of these otherwise intangible characteristics of piston rings, as revealed by the lap gage, the defects have been traced to their origin. Thus the way was paved for the elimination of such defects, resulting in the standardized production of piston rings having uniform and accurate seating characteristics.

Coatings applied on piston rings as a remedial measure to counteract the effects of non-uniform seating are not to be construed as bridging the manufacturing accuracy problem. Where areas of supernormal pressures exist, the obvious advantages of a coating in the alleviation of the scuffing hazard have been demonstrated. The coating, however, does not compensate for low pressure areas, as the lap gage demonstrates. The low pressure areas persist after the coating has disappeared. Nor does a coating incline the ring face at an angle to the cylinder wall where no inclination is provided in machining.

NEWS OF THE INDUSTRY

GM'S 1940 Price Policy Aimed At Elimination of "Packing"

Dealers Will Use Steering Wheel Price Tags Itemizing All Charges On New Cars

Establishment of a new pricing policy under which car buyers will understand plainly the maximum price they are being charged for a new automobile, including the various items entering into that maximum price, has been announced by General Motors to take effect concurrently with the introduction of 1940 models by its dealers.

This new policy as discussed by Alfred P. Sloan, Jr., chairman of General Motors, in his message to GM dealers entitled "The 1940 Program," is aimed directly at the elimination of price "packing" which, in greater or less degree in some trading areas, has crept into the final delivered prices paid for new cars largely to offset over allowances on traded-in used cars.

Under this new policy General Motors dealers will make plain to the public in a variety of ways the maximum price they propose to charge on every new car offered for sale. Quotations of cash delivered prices will be broken down to show: (a) the factory delivered price (which is nominally the cash price at which a buyer could take delivery of a new car at the factory; (b) transportation charges (based on rail freight between the factory and the dealer's place of business); (c) state and local taxes, if any. The factory delivered price includes the price of all items which are commonly considered standard equipment, such as bumpers, etc.

To these items will be added further statements covering the cost of "optional" or additional equipment and the charges being made for financing, if the car is bought on time payments.

This maximum price policy has been made effective, it is understood, by an addition to the 1940 dealer contracts which requires GM dealers to supply car buyers in all cases with a plain, readable invoice clearly stating the prices on each item entering into the maximum price charged so that the buyer, if he is inclined to do so, can easily determine what he is being asked to pay for his new car, item by item.

The policy is being given further effectiveness through the use of steering wheel price tags on which the following data is itemized: (a) factory delivered price of car; (b) transportation charge; (c) total delivered cash price; (d) itemized statement of cost of each piece of optional equipment or

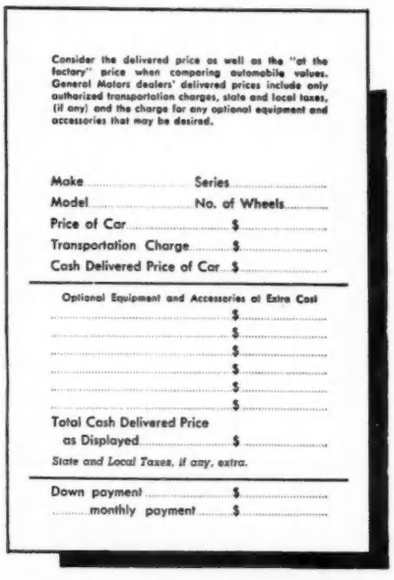
(*Turn to page 461, please*)

Judge Lederle Approves Reo Reorganization Plan

Final approval of a reorganization plan for Reo Motor Car Co. was placed in the hands of stockholders on Oct. 3 by Judge A. F. Lederle in U. S. District Court in Detroit when he approved the proposal which had been submitted by Theodore I. Fry, trustee, after hearings which had extended over a period of several months.

Stockholders were given 30 days to approve the plan which provides for three voting trustees to control the operation of the company for a period not to exceed 10 years and includes a loan of $2,000,000 from the Reconstruction Finance Corp. The voting trustees were insisted upon by the RFC as a condition for making the loan in order to insure a continuance of manufacturing policy during the life of the loan. The loan would be paid off in six years at the rate of $24,000 per month. Trustees named by the court were John W. Miner, Jackson, Mich., attorney and banker; Otto S. Seyferth, Muskegon manufacturer and George B. Judson, Detroit banker.

Provisions of the plan call for payment of all creditors with claims of less than $1000 in cash out of the RFC loan, payment of claims exceeding $1000 out of the segregation and gradual liquidation of assets valued at $1,250,000. These claims total $415,000 and the assets involved consist largely of real estate in Lansing, Chicago and Detroit and machinery not essential for production purposes.



Consider the delivered price as well as the "at the factory" price when comparing automobile values. General Motors dealers' delivered prices include only authorized transportation charges, state and local taxes, (if any) and the charge for any optional equipment and accessories that may be desired.

Make ..... Series .....
Model ..... No. of Wheels .....
Price of Car ..... $ .....
Transportation Charge ..... $ .....
Cash Delivered Price of Car ..... $ .....

Optional Equipment and Accessories at Extra Cost
..... $ .....
..... $ .....
..... $ .....
..... $ .....
..... $ .....
..... $ .....

Total Cash Delivered Price as Displayed ..... $ .....
State and Local Taxes, if any, extra.

Down payment ..... $ .....
..... monthly payment ..... $ .....

Steering Wheel Price Tag

A sample steering wheel price tag (approximately half size) which GM dealers will use in connection with the corporation's 1940 price policy aimed at the elimination of "packing." R. H. Grant, vice-president in charge of sales, observes "That this policy marks a step in new car merchandising which some day will be looked upon as being as significant as the decision of John Wanamaker to put price tags on all of his merchandise".

Diamond T Announces Two New 1½-Ton Models

Two new 1½-ton cab-forward models have been announced by the Diamond T Motor Car Co., featuring a saving of nearly three feet in wheelbase on conventional models.

Model 306SC carries a gross rating of 11,000 lb. and a bare chassis price of $775. The Diamond T-Hercules special 221 cu. in. CBQXC3 engine is standard equipment, with 10-in. clutch and four-speed transmission. Maximum torque is 154 lb.-ft., and 69 hp. is developed at 3000 r.p.m.

Model 404SC has a deeper and heavier frame and the larger and more powerful CBJXE3 engine, of 245 cu. in. displacement, 170 lb-ft. torque, and 76 hp. at 2800 r.p.m. Chassis price is $885 and gross rating is 13,000 lb. Clutch is an 11-in. Borg-Warner, and the helical-gear, four-speed Spicer 2341 transmission is standard.

Both trucks are built in a range of wheelbases to accommodate bodies up to 16 ft. in length.

Passenger Car and Truck Production

(U. S. and Canada)

	August 1939	July 1939	August 1938	EIGHT MONTHS 1939	EIGHT MONTHS 1938	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	56,233	142,346	53,955	1,677,130	978,015	+71.3
Foreign Market—U. S.	5,151	8,392	4,669	117,143	123,967	− 5.4
Canada	1,068	5,112	3,063	76,148	84,438	− 9.7
Total	62,452	155,850	61,687	1,870,421	1,186,420	+58.0
Trucks—U. S. and Canada						
Domestic Market—U. S.	29,393	43,919	23,259	371,611	239,895	+55.0
Foreign Market—U. S.	9,091	14,686	8,611	105,240	93,403	+12.8
Canada	2,407	4,023	3,389	30,217	33,179	− 8.8
Total	40,891	62,628	35,259	507,068	366,477	+38.4
Total—Domestic Market—U. S.	85,626	186,265	77,214	2,048,741	1,217,910	+69.9
Total—Foreign Market—U. S.	14,242	23,078	13,280	222,383	217,370	+ 2.2
Total—Canada	3,475	9,135	6,452	106,365	117,617	− 9.5
Total—Cars and Trucks—U. S. and Canada	103,343	218,478	96,946	2,377,489	1,552,897	+53.0

Steady Rise in Scrap Prices Worries Producers of Steel

Blame Placed Chiefly on Smaller Dealers Who Are Withholding Their Supply from the Market

Steel mill executives conferred recently regarding what might be done to halt the steady rise of scrap prices, which are 33 1/3 to 50 per cent higher than they were in midsummer. With their order books filled to take care of their next few months' output, steel producers list this bulge in scrap prices as their chief worry.

Automobile manufacturers and parts makers are among the important "producers" and sellers of scrap as well as the largest consumers of finished steel. They buy, however, much more scrap in their steel than they have occasion to dispose of in the form of borings, turnings and clippings and, therefore, are much more interested in steel mills being enabled to obtain their scrap supply at reasonable levels, so that finished steel product prices may ride on an even keel, than in getting a few dollars a year more for the scrap sold by them to dealers.

Although in some quarters the present paucity in the supply of scrap is attributed to heavy shipments to Japan and Italy long before the acute crisis developed in Europe, the withholding from the market of their scrap holdings by a considerable number of smaller dealers is being chiefly blamed for the prevailing state of affairs. Technical developments have made for a steadily increasing ratio of scrap in steel furnace charges in the past twenty years, until today scrap, and no longer pig iron, has became the steel producer's most important raw material. Time and again efforts have been made to eliminate the kinks that tend to impair the free flow of scrap from producers' plants to steel mills. This problem would be relatively easy to solve in the case of industrial scrap, but perhaps the largest contribution to the scrap supply comes from non-industrial sources, among which the railroads, disposing periodically of outworn track and other material, are the most important. Much of this type of scrap must be properly cut and otherwise prepared before it is acceptable to steel mills, and under the present setup the scrap iron specialists, who perform this service, are considered an economic necessity, but what the steel producers are seeking to eliminate is the forcing upward of prices through speculative maneuvers of middlemen, who have little or no part in the processing of the scrap. This problem has arisen before and been solved, whenever scrap prices became unreasonably high. It is quite possible that by the time 1940 steel prices become effective, scrap will be selling at more reasonable levels. Ingot output for the week ended Oct. 7 was at the rate of 87½ per cent of capacity, the top record in 10 years.

Scrap is also to the front as perhaps the most important factor in the copper market. Producers of primary metal have not advanced their price, which remains at 12 cents a pound for spot electrolytic, but strong pressure was being exerted by refiners of secondary or scrap copper to lift the price to 12½ cents. It appears that the mine producers are allocating copper to their regular customers and fabricating subsidiaries and that, as a result, an "outside" market has been built up at 12½ cents, which price semi-speculative buyers are willing to pay. Connecticut brass mills are well supplied and there is relatively little additional consuming demand coming out.

The cutting off of information regarding steamship manifests, ordered as a war precaution by the Customs Division of the Treasury Department, has further impaired visibility in the tin market. Some Straits tin, due to arrive in December, has been sold at 46½ cents.—W. C. H.

CALENDAR

Conventions and Meetings

SAE Annual Dinner, Hotel Pennsylvania. New York, N. Y. .....Oct. 16
American Welding Society, Annual Meeting, Chicago .....Oct. 22-27
American Trucking Association, Annual Meeting, Chicago .....Oct. 23-24
SAE Transportation & Maintenance Meeting, Coronado Hotel, St. Louis, Mo. .....Oct. 26-27
SAE Fuels & Lubricants Meeting, Mayo Hotel, Tulsa, Okla.....Nov. 2-3
National Wheel & Rim Association, Jacksonville, Fla. .....Nov. 6-8
American Finance Conference, Sixth Annual Business Convention, Palmer House, Chicago .....Nov. 8-9
American Petroleum Institute, Annual Meeting, Chicago .....Nov. 13-17
National Independent Traffic League, Annual Meeting, Chicago....Nov. 23-24
Motor & Equipment Wholesalers Association, Annual Convention, Chicago .....Dec. 8-9
SAE Annual Meeting & Engineering Display, Book-Cadillac Hotel, Detroit .....Jan. 15-19, 1940

Shows at Home and Abroad

Newark, N. J., Automobile Show.Oct. 21-28
Baltimore, Md., Automobile Show, Oct. 21-28
Buffalo, N. Y., Automobile Show.Oct. 21-28

Estimated Dealer Stocks of New Passenger Cars

1938	July	August	September	October	November	December
Production—U. S. Domestic Market †	96,975	53,955	60,177	171,371	295,366	305,900
Retail Sales—U. S. ‡	153,426	123,711	90,629	134,984	241,009	241,623
Change in Inventory	−56,451	−69,756	−30,452	+36,387	+54,357	+64,277
Inventory, first of month	263,618	207,167	137,411	106,959	143,346	197,703
1939	**January**	**February**	**March**	**April**	**May**	**June**
Production—U. S. Domestic Market †	263,225	223,745	279,148	257,058	222,909	233,311
Retail Sales—U. S. ‡	180,651	165,841	276,301	265,756	275,457	254,304
Change in Inventory	+82,574	+57,904	+2,847	−8,698	−52,548	−20,993
Inventory, first of month	261,980	344,554	402,458	405,305	396,607	344,059
1939 (continued)	**July**	**August**	**September**	**October**	**November**	**December**
Production—U. S. Domestic Market †	142,346	56,233	.....	.....	.....	.....
Retail Sales—U. S. ‡	229,220	166,070	.....	.....	.....	.....
Change in Inventory	−86,874	−109,837	.....	.....	.....	.....
Inventory, first of month	323,066	236,192	126,355	.....	.....	.....

†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.

Detroit, Mich., Automobile Show.Oct. 21-28
Milwaukee, Wis., Automobile Show, Oct. 21-28
Pittsburgh, Pa., Automobile Show, Oct. 21-28
St. Louis, Mo., Automobile Show.Oct. 22-28
National Metals Congress and Exposition, Chicago .....Oct. 23-27
Philadelphia, Pa., Automobile Show, Oct. 26-Nov. 1
International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6
San Francisco, Cal., Automobile Show, Nov. 3-9
Chicago, Ill., Automobile Show...Nov. 4-12
National Truck Show, Chicago...Nov. 8-16
Great Britain, Glasgow, Scotch Automobile Show .....Nov. 10-18
Butte, Mont., Automobile Show....Dec. 4-5
Automotive Service Industries Show, Navy Pier, Chicago .....Dec. 11-16

Chrysler Prices For 1940 Models

Detroit delivered prices for 1940 Chrysler passenger cars, including federal taxes, have been announced as follows:

	Royal	Windsor	Traveler	New Yorker
Three-passenger coupe	$895	$935	$1095	$1175
Five-passenger coupe..	960	995	1150	1230
Six-passenger Victoria sedan	960	995	1150	1230
Six-passenger sedan...	995	1025	1180	1260

40 YEARS AGO

Electric vehicle promoters in Europe are wonderfully fertile in excuses. The London electric cabs were withdrawn because the motormen were hired away by private owners of automobiles; the electric cabs of Paris were taken out of the cheap cab class because the drivers were in continual squabbles with their fares, and now we learn that the Brussels electric cabs have been discontinued because the brakes didn't work right.

From *The Horseless Age*, October, 1899.

Small Eastern Steel Mills Win Minimum Wage Decision

Ourselves and Government—A Check List Of Federal Action Corrected to October 6

LABOR DEPARTMENT

STEEL WAGE CASE—In a far-reaching decision sustaining the contention of seven small independent steel mills that the Secretary of Labor exceeded her authority in grouping 13 Eastern states in one locality for the purpose of fixing minimum steel wage rates under the Walsh-Healey Public Contracts Act, the United States Circuit Court of Appeals for the District of Columbia has ruled that the Secretary's steel wage determination "goes so far beyond any possible proper application of the word (locality) as to defeat its meaning and to constitute an attempt arbitrarily to disregard the statutory mandate."

The two to one decision, which marks a major victory for the small Eastern mills, may ultimately have the effect of voiding all wage determinations thus far made under the law. In fixing a wage for government contractors in the aircraft industry, for example, the Secretary determined that the entire country comprises one "locality."

FEDERAL TRADE COMMISSION

F.O.B. PRICE CASE — Testimony closed in GM case, with trial examiners report having been served on respondent company. After final arguments, the FTC order is next in line. Trial examiners report still due in Ford case. Both cases involve the FTC allegation that the companies engaged in misleading price advertising.

VS. GENERAL MOTORS—Trial examiners report due. Rebuttal testimony concluded Sept. 11. The FTC charge is that GM dealers are required to handle GM parts exclusively.

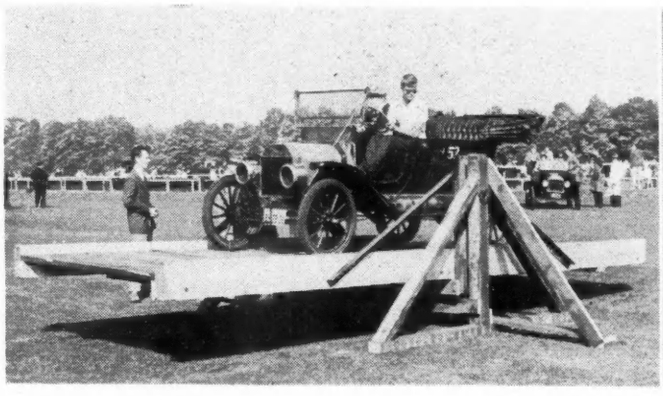
SIX PER CENT CASE—Final arguments completed in both Ford and GM cases involving the Commission allegation that companies engaged in misleading representation in finance plan advertising. Cease and desist orders may be next development.

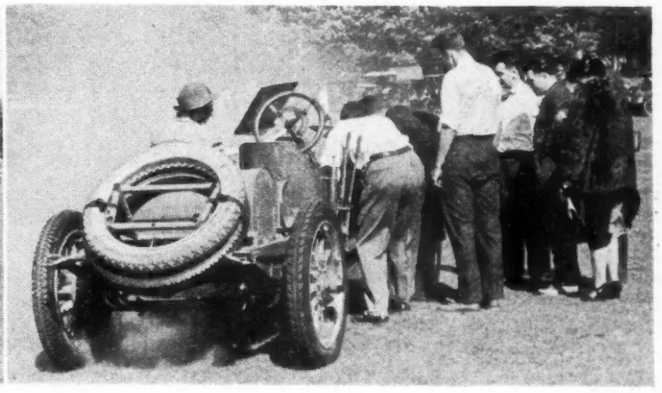
FAIR TRADE PRACTICE RULES —No indication when rules, now long overdue, will be promulgated.

Truck Production by Capacities

(U. S. and Canada)

	EIGHT MONTHS			PER CENT OF TOTAL	
	1939	1938	Per Cent Change	1939	1938
1½ Tons and less	466,256	340,450	+ 37.0	91.94	92.90
2 to 3 Tons	22,926	13,503	+ 69.5	4.52	3.69
3½ Tons and over	8,910	6,135	+ 45.4	1.76	1.67
Special and buses	9,026	6,389	+ 41.3	1.78	1.74
Total	507,118	366,477	+ 38.4	100.50	100.00

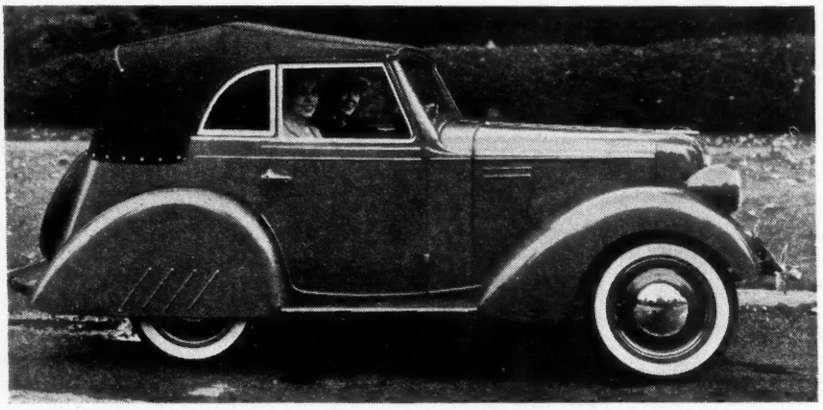




Acme

Vintage Prior to 1911

The Veteran Motor Car Club of America, organized at an informal dinner last winter by a group of men whose hobby is collecting and reconditioning ancient automobiles, recently held a meet at Raceland on the estate of J. R. Macomber in Framingham Center, Mass. The cars, they must be of vintage prior to 1911, met in a series of contests designed to demonstrate their efficiency, dependability and safety. At the left Henry A. Clark, Jr., balances his 1910 Ford on a huge see-saw in a test in which the driver endeavors to keep both ends of the platform off the ground. The car appearing in the scene at the right is an old Milano.



The Bantam "Super 4"

This convertible sedan is one of two new models offered for 1940 by the American Bantam Car Co. Door glasses are framed in chromium and recede completely into the doors when lowered. Companion to the sedan is a new convertible coupe.

Bantam Offers New Convertible Coupe and Sedan in 1940 Line

Horsepower of Engine Increased 20 Per Cent To 8.172 SAE by Enlarging Bore and Stroke

Bantam's 1940 line includes two new "Super 4" models, a convertible coupe and sedan. A business coupe is the lowest priced car in the line, delivering at the factory in Butler, Pa., for $399. For buyers who want custom equipment, Bantam offers the convertible sedan in a Riviera model and the coupe in a Hollywood model with leather upholstery, whitewall tires, dual horns and taillights, running boards, chrome wheel rings and complete deluxe accessories. Other Bantam passenger cars are the Master coupe, delivered at $449 and the Master roadster at $449. The station wagon model is continued.

The commercial line includes a one-quarter-ton panel truck and a new quarter-ton pickup. The pickup is available with a new type of tow bar that allows it to be used for pickup and delivery of cars by garages, service stations and automobile dealers.

Horsepower of the "Hillmaster" engine has been increased 20 per cent to 8.172 SAE by enlarging the bore to 2.260 in. and the stroke to 3.125 in. The engine is mounted in Firestone rubber mountings, and a three-main-bearing crankshaft replaces the former two-bearing crankshaft.

Additional specifications include the following: Six-volt, two-unit type Auto-Lite electrical system; Zenith adjustable jet carburetor; Rockford Glideaway clutch—single plate, dry disc, 8½-in. diameter; Warner Gear, standard shift, synchro-mesh, silent second type transmission; Spicer drop-forged steel I-beam section front axle; Spicer semi-floating spiral bevel type rear axle; Monroe hydraulic shock absorbers. The drive on the Bantam cars is the heavy Hotchkiss type, single tubular propeller shaft from transmission to differential. Steering is listed as Ross cam and lever. Springs: front, transverse; rear, semi-elliptic, parallel mounted. Safety glass is used all around.

The general dimensions are: ground clearance, 8 in.; wheelbase, 75 in.; tread—front, 40 in., rear, 42 in.; weight, with average body and full equipment, 1200 lb.

MEN . . . . . .

R. M. Sale, assistant domestic sales manager of Ford Motor Co. of Canada Ltd., Windsor, Ont., for the past 10 years has been appointed sales manager.

Richard W. Yerkes has tendered his resignation as secretary-treasurer of the Link-Belt Co., Chicago. He will continue to serve the company as a member of the board of directors. **Harry E. Kellogg,** who has been closely associated with Mr. Yerkes for the last

New Passenger Car Registrations

	August 1939	July 1939	August 1938	EIGHT MONTHS 1939	EIGHT MONTHS 1938	Per Cent Change, 8 Months, 1939 over 1938	Per Cent of Total Eight Months 1939	Per Cent of Total Eight Months 1938	TEN MONTHS MODEL YEAR 1939	TEN MONTHS MODEL YEAR 1938	TEN MONTHS MODEL YEAR Per Cent Change
Chevrolet	40,666	52,096	35,683	424,657	313,092	+ 35.5	23.32	25.03	528,641	418,507	+ 26.5
Ford	36,933	47,043	27,079	336,758	262,408	+ 28.2	18.49	20.98	403,344	309,778	+ 30.1
Plymouth	25,198	30,826	14,675	254,651	172,953	+ 46.3	13.98	13.91	321,943	223,632	+ 44.0
Dodge	12,798	17,796	6,735	139,313	69,689	+100.0	7.65	5.57	167,382	95,300	+ 75.8
Buick	10,688	15,576	10,173	134,819	103,336	+ 30.4	7.40	8.26	172,650	137,144	+ 25.7
Pontiac	7,978	11,902	5,747	102,159	63,464	+ 61.1	5.61	5.07	127,899	86,351	+ 48.0
Oldsmobile	8,480	10,649	5,856	93,278	60,442	+ 55.6	5.12	4.83	118,681	80,591	+ 47.1
Studebaker	7,818	8,003	3,179	51,143	23,550	+117.5	2.81	1.89	60,611	31,251	+ 94.0
Chrysler	5,028	5,895	2,997	48,555	32,042	+ 51.3	2.67	2.56	59,352	44,405	+ 34.0
Mercury	5,335	6,394		44,037			2.42		50,872		
De Soto	5,010	5,203	2,594	38,671	24,286	+ 59.0	2.12	1.94	46,756	33,469	+ 39.6
Nash	3,362	4,180	2,528	36,376	22,613	+ 61.0	2.00	1.81	41,980	29,959	+ 40.0
Hudson	3,015	4,250	2,854	33,387	26,953	+ 24.0	1.83	2.15	42,794	36,222	+ 18.3
Packard	4,541	3,120	3,455	32,096	32,810	− 2.1	1.76	2.62	41,163	43,619	− 5.9
La Salle	1,528	1,634	981	14,617	9,335	+ 56.7	.81	.75	19,221	12,774	+ 50.5
Lincoln	1,491	1,697	1,170	13,557	11,940	+ 13.4	.74	.95	16,919	15,380	+ 10.1
Cadillac	867	920	619	8,728	7,074	+ 23.2	.49	.57	11,384	8,331	+ 36.5
Willys-Overland	1,038	943	1,119	8,004	9,053	− 11.5	.44	.72	9,926	13,506	− 26.4
Graham	344	400	258	3,185	3,000	+ 6.1	.17	.24	3,899	4,360	− 10.5
Crosley	263	541		894			.06		894		
Bantam	142	132		856			.05		856		
Hupmobile	75	71	111	816	816	None	.04	.07	917	922	− 0.5
Fiat	4	8		70					70		
Miscellaneous	31	29	141	416	1,017	− 59.0	.02	.08	722	1,463	− 50.6
Total	182,633	229,308	127,954	1,821,043	1,250,873	+ 45.6	100.00	100.00	2,243,876	1,626,954	+ 38.4
Chrysler Corp.	48,034	59,720	27,001	481,190	299,970	+ 60.5	26.42	23.98	595,433	336,806	+ 49.9
Ford Motors Corp.	43,759	55,134	28,249	394,352	274,384	+ 43.8	21.66	21.93	471,135	325,158	+ 45.0
General Motors Corp.	70,207	92,777	59,059	778,258	556,743	+ 39.8	42.74	44.51	978,476	743,698	+ 31.5
All Others	20,633	21,677	13,645	167,243	119,812	+ 39.8	9.18	9.58	233,832	161,302	+ 26.0

18 years, has been elected to succeed him as treasurer. **F. V. MacArthur,** formerly assistant secretary, has been elected secretary.

Promotions in the engineering department of the Buick division of General Motors have been announced as follows: **John Dolza,** formerly assistant chief engineer, becomes special project engineer assigned to advance development problems; **Edward T. Ragsdale,** for the past several years Buick's body engineer, is promoted to assistant chief engineer, retaining, however, direct supervision over all body and sheet metal engineering activities; **Verner P. Mathews,** an engineer in the chassis division for the past 12 years, becomes chassis engineer in charge of all chassis engineering activities; **James H. Booth,** who since 1935 has specialized in steering suspensions and other phases having to do with ride and handling becomes chassis division engineer in charge of that phase of car design and construction; and **Edward F. Reynolds,** formerly assistant body engineer, becomes body division engineer.

Dr. Karl Taylor Compton, president, Massachusetts Institute of Technology, will address the 1939 Annual Dinner of the Society of Automotive Engineers at the Pennsylvania Hotel, New York, Oct. 16.

Howard B. Brown of Philadelphia has been named secretary of the Pittsburgh Plate Glass Co., Pittsburgh, Pa., to succeed the late Carl S. Lamb.

Chester C. Codding has been promoted to the position of divisional manager for Willys-Overland Motors, Inc., on the West Coast.

Wallace R. Campbell, president of the Ford Motor Co. of Canada, Ltd., Windsor, Ont., has been named chairman of the Canadian War Supply Board with headquarters at Ottawa.

John T. Beatty has been elected president of the United Specialties Co., Detroit, succeeding **M. D. Harrison** who was made secretary and treasurer.

Don Herr has been appointed by the Ramsey Accessories Mfg. Corp. to take charge of sales in Kentucky, Indiana, Illinois, Wisconsin, Minnesota, The Dakotas, Iowa and Missouri.

Automotive Heads Named to "Emergency" Committees

About 300 representatives of business and industry have been designated by the United States Chamber of Commerce to serve on committees whose job will be to prepare for the consideration of emergency problems resulting from war conditions. A. L. Frank, president of the Studebaker Export Corp., South Bend, Ind., has been named to the foreign commerce committee, and B. C. Heacock, president of the Caterpillar Tractor Co., Peoria, Ill., to the committee on manufacture.

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Manufacturing operations in several large plants are slowly but surely moving to higher output levels. One source remarks, "If we get half of the orders now pending, our schedules will really shoot up."

TRUCKS From a sampling of producers in this field emerges the general opinion "Production increase satisfactory over a year ago". There is every indication that the year will finish strong.

TRACTORS Production is steadily increasing to capacity schedules.

AUTOMOBILES It appears likely that car and truck production will exceed 100,000 units weekly before the end of October is reached. Industry leaders are estimating that output for the calendar year will probably reach 3,700,000 or 3,800,000 units.

MARINE ENGINES One manufacturer reports that production has been increased appreciably. The future is viewed optimistically, especially with regard to Diesel engines.

AIRCRAFT ENGINES Production continues at a brisk rate, although fear is expressed in some quarters that the large backlogs will shrink.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

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DeSoto Price Reductions Range from $20 to $48

Price reductions on all 1940 DeSoto models ranging from $20 to $48 have been made. The prices for each body type in the line, with exception of the new convertible coupe which is to be priced later, are as follows: DeLuxe coupe, $845; DeLuxe two-door touring sedan, $905; DeLuxe coupe with auxiliary seats, $905; DeLuxe four-door touring sedan, $945; DeLuxe seven-passenger sedan, $1,175; Custom coupe, $885; Custom two-door touring sedan, $945; Custom coupe with auxiliary seats, $945; Custom four-door touring sedan $985; Custom seven-passenger sedan, $1,215; Custom seven-passenger limousine, $1,290.

The foregoing are delivered at Detroit prices and include federal excise tax.

Harris & Ewing

George W. Romney

. . . who was recently named manager of the Detroit Office of the Automobile Manufacturers Association. Mr. Romney, who comes from Utah, has been representative of the aluminum industry at Washington for several years

PUBLICATIONS

Leeds & Northrup Co., Philadelphia, Pa., has issued a catalog describing the company's new potentiometer-type **industrial optical pyrometer.***

"Highway Transportation Re-makes America" is the title of a booklet prepared by the National Highway Users Conference, National Press Building, Washington, D. C.

A revised edition of the booklet, **"Haynes Stellite J-Metal Cutting Tools"**, has been published by Haynes Stellite Co., a unit of Union Carbide & Carbon Corp.*

Bulletin No. 58-H, issued by the Niagara Machine & Tool Works, Buffalo, N. Y., describes the company's line of **open back inclinable presses.***

Norton Co., Worcester, Mass., has prepared a condensed catalog listing its stock **grinding wheels.***

Carboloy Co., Inc., Detroit, has issued a bulletin giving the latest methods of **torch brazing Carboloy tools.***

"101 Welding Ideas for Low Cost Maintenance" is the title of a bulletin prepared by the Lincoln Electric Co., Cleveland, Ohio.*

The Black & Decker Mfg. Co., Towson, Md., has brought out a booklet entitled **"The Proper Care and Maintenance of Portable Electric Tools".***

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for Automotive Industries

Swift acceleration in business activity continues. Further expansion in retail trade was reported for the final week in September by Dun & Bradstreet with total volume estimated from 6 to 12 per cent greater than a year ago. The business index of the *New York Times* rose from 100.0 to 101.1 during the week ended Sept. 23, comparing with 84.3 a year ago. The *Journal of Commerce* index for the same period stood at 105.1 as against 101.0 a week earlier and 86.1 for the similar period last year.

The railway freight movement has reflected the general upward trend. Loadings in the week ended Sept. 23 reached a new peak for the year to date, totaling 814,828 cars as compared with 805,733 cars in the preceding week and 669,704 cars a year ago.

Production of electricity by the electric light and power industry during the same period rose to a new all-time peak, exceeding the total for the corresponding week last year by 13.7 per cent. This increase compares with one of 10.4 per cent a week earlier.

Bank debits to individual accounts in leading cities in the week ended Sept. 20 two per cent below the total for the preceding week but six per cent above that for the corresponding period last year.

After rising sharply for several weeks following the shut-down in principal producing states, crude oil production turned downward in the week ended Sept. 30. Output during that period averaged 3,658,200 barrels daily as against 3,681,050 barrels a week earlier. The current level compares with average daily requirements of 3,510,700 barrels as calculated by the Bureau of Mines for September.

Bituminous coal production averaged 1,533,000 tons daily during the week ended Sept. 23 as against 1,483,000 tons in the preceding week and 1,302,000 tons a year ago.

A special survey by the Department of Labor indicates an increase of more than 300,000 in factory employment between mid-August and mid-September. Only one-third of the gain is regarded as attributable to the usual seasonal influences.

Professor Fisher's index of wholesale commodity prices stood at 83.6 for the week ended Sept. 30 as against 83.2 a week earlier and 78.1 five weeks earlier.

Excess reserves of the member banks of the Federal Reserve System rose to a new peak of $5,330,000,000 during the week ended Sept. 27, showing an increase of $50,000,000 over the total for the preceding week. The monetary gold stock increased $23,000,000 and the amount of money in circulation $2,000,000, while the amount of reserve bank credit outstanding declined $37,000,000 and treasury cash and deposits with the reserve banks $79,000,000.

Labor Situation Only Blot On Outlook for Last-Quarter

Several Strikes Under Way as New Model Production Gathers Momentum

Biggest question mark in the automotive industry's otherwise rosy picture for the last quarter of 1939 was the labor situation with several strikes underway as the new model season went into full swing and unions reported to be preparing new demands to serve on a number of manufacturers.

Most important recent development was the one-sided victory won by the CIO contingent of the UAW in plant elections held under sponsorship of the National Labor Relations Board in all Chrysler plants. The CIO won elections over the AFL and a number of independent unions in 11 of 13 Chrysler plants. The AFL won only in the Chrysler plant at Evansville, Ind., and also in the tool and die division at the Newcastle, Ind., plant, while workers in the Kokomo, Ind., plant voted to be represented by neither union.

CIO leaders have announced they were preparing a list of demands for revisions of the present contract with Chrysler. The contract expired at the end of April but was renewed on a month to month basis through September. CIO leaders at Briggs Mfg. Co. called off a strike vote in plants of the company for the announced purpose of not hampering efforts of the Chrysler union in their proposed negotiations on a new contract.

Meanwhile the NLRB was scheduled to hold hearings on petitions of the AFL for plant elections in 15 General Motors plants to determine whether the AFL or CIO should represent employes in these plants. No election has been asked in 42 other GM plants where the CIO now claims sole bargaining rights. General Motors announced on Oct. 5 that it had referred to the NLRB a request from the CIO which asked recognition of that union as sole bargainer for employes in all GM plants. As this was written the CIO was conducting strikes in the plants of all Detroit manufacturers of engine bearings, in Kenosha and Milwaukee plants of Nash-Kelvinator, at Midland Steel Products Co., Cleveland, and the Long Mfg. Div. of Borg Warner Corp., Detroit.

Hoof Products Expands Its Testing Facilities

Hoof Products Co., Chicago, manufacturers of Hoof Cantilever Spring Governors and Brake Eyes, a safety device for hydraulic brakes, reports that it has expanded its testing facilities with the addition of another dynamometer.

Arthur Nutt Nominated SAE President for 1940

Arthur Nutt, since 1930 vice-president in charge of engineering for the Wright Aeronautical Corp., has been nominated president of the Society of Automotive Engineers for 1940. Mr. Nutt previously served the SAE as an officer during 1925 and 1930 when he was vice-president representing aircraft-engine engineering. He is a licensed professional engineer in New York and New Jersey, a member of the Subcommitee on Fuels & Lubricants for the National Advisory Committee for Aeronautics, also a member of the

New Truck Registrations

	August 1939	July 1939	August 1938	EIGHT MONTHS 1939	EIGHT MONTHS 1938	Per Cent Change, 8 Months 1939 over 1938	Per Cent of Total Eight Months 1939	Per Cent of Total Eight Months 1938
Chevrolet	14,327	15,432	11,268	118,642	87,616	+ 35.1	35.20	33.22
Ford	12,090	12,514	9,471	90,063	73,463	+ 22.8	26.72	27.85
International	6,101	5,744	5,361	42,522	37,416	+ 13.8	12.61	14.18
Dodge	4,709	4,562	3,286	36,328	26,121	+ 39.0	10.78	9.90
G. M. C.	3,031	2,872	1,909	22,475	14,353	+ 56.5	6.67	5.44
Plymouth	793	946	593	6,667	5,473	+ 21.9	1.98	2.07
Mack	524	541	370	4,233	2,628	+ 61.1	1.26	1.00
Diamond T	449	436	397	3,316	3,020	+ 9.6	.98	1.14
White	365	358	250	2,927	2,364	+ 24.0	.87	.90
Studebaker	238	229	209	1,547	1,366	+ 13.2	.45	.52
Autocar	185	300	88	1,407	1,100	+ 27.9	.42	.42
Brockway	146	170	111	1,202	819	+ 47.0	.36	.31
Willys-Overland	92	133	158	1,054	1,385	+ 76.3	.31	.53
Federal	158	116	125	1,008	936	+ 6.9	.30	.35
Divco	84	117	96	982	881	+ 11.4	.29	.33
Reo	28	31	231	799	1,966	− 59.3	.24	.75
Bantam	59	53		387			.11	
Hudson	28	43	61	345	606	− 43.0	.10	.23
Sterling	38	28	23	231	171	+ 35.0	.07	.06
Indiana	12	21	39	139	320	− 56.5	.04	.12
F. W. D.	8	34	13	125	218	− 42.6	.04	.08
Miscellaneous	58	67	172	697	1,551	− 55.1	.20	.60
Total	43,523	44,747	34,231	337,096	263,773	+ 28.0	100.00	100.00

Arthur Nutt

. . . Vice-president in charge of engineering for the Wright Aeronautical Corp. who has been nominated president of the Society of Automotive Engineers for 1940

National Aeronautic Association and the Institute of the Aeronautical Sciences.

Other SAE nominees for 1940 are as follows: *Treasurer*, David Beecroft, Bendix Products division, Bendix Aviation Corp.; *Councilors* (Term of 1940-1941), Murray Fahnestock, editor, Ford Dealer & Service Field Magazine, James B. Fisher, vice-president, Waukesha Motor Co., Austin M. Wolf, automotive consultant; *Vice-Presidents*, Aircraft, S. J. Zand, consulting engineer, Sperry Gyroscope Co., Inc.; Aircraft-Engine, N. N. Tilley, chief engineer, Detroit Plant, Continental Motors Corp.; Diesel-Engine, C. G. A. Rosen, assistant chief engineer in charge of Diesel Research, Caterpillar Tractor Co.; Fuels & Lubricants, Neil MacCoull, research engineer, The Texas Co.; Passenger-Car, James C. Zeder, chief engineer, Chrysler Corp.; Passenger-Car-Body, John Oswald, Olds Motors Works division, General Motors Corp.; Production, Edwin R. Smith, vice-president and general manager, Seneca Falls Machine Co.; Tractor & Industrial Power Equipment, J. M. Davies, research engineer, Caterpillar Tractor Co.; Transportation & Maintenance, G. W. Laurie, manager, automotive transportation, Atlantic Refining Co., and Truck, Bus & Railcar, B. Frank Jones, chief engineer, Truck division, White Motor Co.

Members of the 1940 Council will include also the following three men who were elected at the beginning of 1939 for a two-year term: W. E. McGraw, chief engineer, Chrysler Corp. of Canada, Ltd., G. L. Neely, research engineer in charge of Fuels and Lubricants, Standard Oil Co. of Calif., A. L. Beall, research engineer, Wright Aeronautical Corp. Serving on the 1940 Council as past president: C. W. Spicer, vice-president, Spicer Mfg. Corp. and W. J. Davidson, general sales manager, Diesel Engine division, General Motors Sales Corp.

GM's Price Policy

(*Continued from page* 455)

accessories; (e) total cash delivered price as displayed; (f) state and local taxes, if any. The tag also permits a statement of the time payment terms including the down payment, number of monthly payments, and the amount of each monthly payment. In addition to the steering wheel tags dealers will use wall placards explaining the maximum delivered price policy; while the corporation plans to advertise extensively to the public its new pricing methods, to the effect that henceforth it is plainly marking the selling price of its merchandise.

From the standpoint of the dealer trade, announcement of the policy makes plain that "packing" includes charges for anything over and above the declared maximum price. It has been pointed out that careful analysis of statements of dealers operating in areas where packing has been a practice compared with those of dealers who have not resorted to packing show that the profit position of the former has been no better than that of the latter; which is logically explained by the fact that packs have been used to make up for over allowances in used car trading. Where there has been any question as to the sufficiency of the gross profit available to dealers, any study of the problem has been beclouded by the use of packs in varying amounts in different sales areas; so that the elimination of this practice is expected to give a more clean-cut picture of the sufficiency of gross margin in the future.

It has not yet been determined whether public announcement of the new policy will involve, or permit, local advertising of local delivered prices.

Furnas and Hoffman to Speak at Safety Meeting

Heads of 46 national organizations united in support of the Standard Highway Safety Program for States will be the guests of honor at the fourth annual luncheon of the Automotive Safety Foundation, to be held in the Hotel Roosevelt, New York City, Oct. 16.

William S. Knudsen, president of the General Motors Corp., will preside at the annual luncheon-meeting. Principal speakers will be J. C. Furnas, author of "And Sudden Death," and Paul G. Hoffman, president of the Foundation and the Studebaker Corp.

Eight-Months' Record of Automotive Exports and Imports

	AUGUST 1939		AUGUST 1938		EIGHT MONTHS ENDED AUGUST 1939		EIGHT MONTHS ENDED AUGUST 1938	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 14,893,279		$ 12,299,236		$ 177,669,837		$ 184,336,846
PASSENGER CARS								
Passenger cars and chassis	3,874	2,316,439	5,286	3,213,980	101,870	62,289,900	106,818	66,796,397
Low price range $850 inclusive	3,500	1,932,121	4,805	2,725,811	91,067	50,860,062	93,367	52,254,109
Medium price range over $850 to $1,200	320	291,349	443	417,282	9,280	8,849,953	11,491	11,209,519
$1,200 to $2,000	49	68,679	27	40,983	1,244	1,839,135	1,562	2,315,496
Over $2,000	5	24,290	11	29,904	279	740,750	398	1,017,273
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	7,585	5,258,863	5,788	3,843,434	82,942	51,312,322	78,963	50,571,427
Under one ton	938	422,759	823	364,364	12,377	5,213,638	12,160	5,154,007
One and up to 1½ tons	5,307	3,177,140	3,759	2,157,456	57,910	31,648,242	52,762	28,941,507
Over 1½ tons to 2½ tons	918	965,194	733	516,207	9,072	8,170,245	8,743	7,050,989
Over 2½ tons	354	599,711	399	728,973	3,004	5,755,929	4,251	8,624,389
Bus chassis	68	94,059	74	76,434	579	524,268	1,047	800,535
PARTS, ETC.								
Parts except engines and tires		2,920,970		1,367,774		27,132,861		31,967,175
Automobile unit assemblies		3,149,381		2,958,168		26,154,944		24,610,994
Automobile parts for replacement (n.e.s.)		388,110		300,358		2,618,837		2,286,368
Other automobile accessories (n.e.s.)								
Automobile service appliances	1,512	499,956	960	407,481	12,784	4,121,669	10,689	4,037,369
Airplanes, seaplanes and other aircraft	138	5,967,025	83	3,358,309	1,093	42,184,616	590	27,936,390
Parts of airplanes, except engines and tires		12,136,845		1,422,351		70,186,620		15,572,201
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	87	207,805	27	167,814	362	1,254,823	335	1,535,575
Other stationary and portable								
Not over 10 hp.	2,224	123,882	1,324	57,786	9,763	567,783	9,802	564,501
Over 10 hp.	228	232,779	120	89,865	1,314	854,208	2,709	1,206,243
Engines for:								
Motor trucks and buses	2,262	266,492	1,720	188,676	18,513	2,244,933	19,228	2,119,324
Passenger cars	511	53,666	512	38,896	18,617	1,621,571	29,783	2,426,037
Aircraft	221	1,844,180	115	578,221	1,220	8,811,116	884	5,015,364
Accessories and parts (carburetors)		265,565		211,861		1,882,244		1,877,850
IMPORTS								
Automobiles (dutiable)	91	57,848	39	25,149	413	296,204	400	256,792

CUTTING FLUIDS

(Continued from page 425)

inent investigators and there exists a better understanding of the need for more efficient cutting fluids.

Generally speaking, the practical function of cutting fluids may be described as follows—

1. To keep the tool cool and prevent it from reaching a temperature at which the hardness and resistance to abrasion are reduced

2. To keep the work cool, thus preventing distortion and promoting dimensional accuracy.

3. To lubricate, thus reducing power consumption, wear on the tool, preventing the generation of excessive heat, preventing chip welding.

4. To promote satisfactory chip formation.

5. To wash away the chips.

Appended to this article is a table listing the principal suppliers of cutting fluids, according to the records of the Chilton Automotive Buyer's Guide. Another table lists the principal products marketed by each of the suppliers, recording the great variety of proprietary brands and blends available to the user. In the interest of simplification, we list below a classification of the types of cutting fluids most generally used in the automotive field—

1. Emulsifiable oils.
2. Sulfurized-mineral oil.
3. Sulfurized-mineral and lard oil.
4. Sulfurized-lard and mineral oil.
5. Mineral-lard oil.
6. Mineral oil.
7. Sulpho-chlorinated oils.

In addition to the foregoing, various chemicals such as phosphorus and chlorine compounds may be found in cutting fluids. Colloidal graphite, mica, white lead, and similar solids also are sometimes used. Colloidal graphite, particularly, has been undergoing production testing over a period of several years to determine its virtues when mixed with soluble oils. An investigation now under way concerns the value of colloidal graphite on the more difficult types of operations such as broaching and tapping.

Quoting from a survey conducted by W. D. Huffman, chief chemist, Chevrolet Gear & Axle Co., we have the following comments on the commonly-used cutting fluids.

"The emulsifiable oils are those oils that form emulsions with water. They are made from mineral oil and various soaps which may be of either petroleum or fatty derivation, together with solvents or other materials to make them homogeneous and to produce a permanent suspension when mixed with water. For applications the emulsifiable oils are mixed with various proportions of water to produce the emulsion, in which form they are used. Because of the great amount of water that can be used in the mixture, they are sometimes des-

Condensed List of Cutting Fluids and Trade Names

Acheson Colloids Corp.—"Aquadag" colloidal graphite for water solutions; "Oildag" for petroleum oil; "Castordag" for mixing with castor oil for heavy broaching operations.

The Acme Refining Co.—"Acmesol" water soluble oil; "Walco" drawing lubricant; "Acmelene" base cutting oil.

Atlas Chemical Co.—Cool-Cut Soluble Oils.

Bayerson Oil Works—Chemico sulfur base blended cutting oils, Emulso soluble oil.

Burns Laboratories, Inc.—Cresol Z-2, modified sulfur-chloride blends.

Cities Service Oil Co.—Chillo cutting oils, a line of oils with special active ingredients; Chillo cutting oils of mineral-lard composition; Grade A and B cutting oils of sulfur-chlorine-mineral oil composition.

The Esso Marketers—Pennex—sulfurized fatty-oil, mineral-oil blends, sulfurized mineral oils, extreme pressure oils; Dortan (transparent)—sulfurized fatty-oil, mineral-oil blends; Fanox, fatty oil mineral oil blends; Kutwell emulsible oils; Velner compounds, water-soluble pastes; Penola tapping and reaming compound.

E. F. Houghton & Co.—Cut-Max Base No. 1, high saponifiable base oil with combined sulfur-extreme pressure treatment; Cut-Max Base No. 2, high saponifiable base oil with extreme pressure treatment without sulfur; Cut-Max Base No. 7, colloidal sulfur-saturated animal hydrocarbon with minimum of 18 per cent added sulfur, contains no mineral oil; Permasol No. 60, water soluble mineral oil producing a milky-white stable emulsion; Hocut No. 60, self-emulsifying oil forming a transparent stable emulsion; Solcut, self emulsifying oil producing a milky emulsion, contains vegetable and animal oils; Soluble Grinding Oil, concentrated self-emulsifying soluble oil producing translucent solution.

The J. W. Kelly Co.—Kelcotene Cutting Oils, Kel-Kut Grinding oil.

Oakite Products Inc.—Oakite Soluble Oil, highly refined from paraffine crude; grinding compound consisting of 4 oz. Oakite to one gallon of water.

Shell Oil Co.—Virgo series soluble oils; Pella series mineral-lard oils; Lata series sulfurized blends.

Smith Oil Co.—Two grades—sulfurized and sulfo-chlorinated cutting oils.

Socony-Vacuum Oil Co.—S/V Sultran cutting oils of straight mineral or mineral-lard composition with sulfur (transparent); S/V soluble oils; S/V special cutting oils for non-ferrous metals.

L. Sonneborn Sons, Inc.—Petromix No. 1 and No. 2—bases for soluble cutting oils.

Standard Oil Co. (Indiana)—Premier line of light colored sulfurized cutting oils; Acme line highly sulfurized dark oils; Standard paste compounds; Superla soluble oils.

D. A. Stuart Oil Co.—"Super-Kool" cutting oil, a series of light colored materials based on a sulfo-chlorinated fatty oil base; "Thred-Kut" cutting oil, a series of dark colored sulfo-chlorinated petroleum oils; "Kleen-Kut" soluble oil; "Codol," liquid grinding compound; various soluble cutting and drawing pastes.

Sun Oil Co.—Sunoco emulsifying cutting oil—for general machining and grinding operations where an emulsifying oil is required. Sunoco emulsifying grinding oil "A": for grinding operations where exceptional wetting out properties are required. Sunicut Series: a broad range of types for use where transparent, sulfurized cutting lubricants are indicated. Sun Thread Grinding Oil: a non-emulsifying product.

The Texas Co.—Texaco Sultex Cutting Oils, series of five grades of sulfurized mineral-lard oils; Texaco Transultex Cutting Oils, transparent sulfurized oils; Texaco soluble oils; Texaco Extra and No. 3 Cutting oils, series of mineral-lard oils; Texaco Oil No. 522, mineral oil.

Tide Water Associated Oil Co.—Tycol series non-tarnishing, transparent sulfurized cutting oils; Tycol soluble oils; Tycol transparent blends of mineral-lard oils.

Wayne Chemical Products Co.—Aqua Sol water soluble pastes; NoSep lubricant; Zeta-Sol emulsifying oil; 3B oil soluble lubricant.

The White & Bagley Co.—Economy cutting oils, for automatic screw machines, milling machines, tapping; Economy Thread Grinding Oils; Economy Form Grinding Oils; Economy Grinding Lubricant, emulsifying paste compound; Economy Soluble Oil; Economy Super Base, highly concentrated sulfurized oil base.

ignated as coolants. They are particularly applicable to those operations where the factor of heat removal from the tool is important and where the lubrication of the machine is not materially reduced.

"The sulfurized-mineral oils are those oils used on more difficult work, or where the problem of tool and machine lubrication is involved. They are made by incorporating additional amounts of sulfur with that which the mineral oil already contains. In evaluating the sulfur as an active reagent in cutting oils, only the added sulfur seems to be effective and not that which is native to the mineral oil. Some plants use a sulfurized-mineral oil with certain percentages of lard oil added, while others prefer the use of a sulfurized-lard oil to which is added a mineral oil. In any case, sulfur and lard oil, or the equivalent of the latter, must be considered as active additions to the mineral oil in the manufacture of a cutting fluid. Mineral-lard oil is a compound of lard oil and mineral oil without added sulfur. Lard oil to the extent of 5, 10 or even 15 per cent is commonly used. Mineral oils without additions of fat or sulfur are considered aids in machining.

"A study of this report reveals a number of topics that will deserve future investigation. There are apparently no limitations as to the use of either emulsions or sulfurized oils. In certain instances, we find that either one is being used on the same types of operation. It seems that a familiarity with the machine and the material to be fabricated, combined with a knowledge of the functions and chemistry of the lubricant should be reliable guides in the selection of cutting fluids. The conditions determining when a soluble oil or straight cutting oil can be used should be clearly defined and simplified if possible. It is realized that this situation is not a simple one, but the two cutting fluids are so different in characteristics that it seems justifiable to assume that the factors governing the choice between the two can be lessened in number.

"Another avenue for investigation is that regarding sulfur and lard oil additions. The amount of sulfur or equivalent that is needed should be determined definitely. It is believed that technical means are now available for solving this problem. Do sulfur and lard oil perform the same functions, or does each contribute different essential characteristics? Many believe that fatty oil or other saponifiable matter can be eliminated and that the straight sulfurized mineral oil will do all that the compounded oils can do."

There are other new developments in cutting fluids that merit attention. For example, some producers are marketing special extreme-pressure materials for the very heavy-duty metal cutting jobs. Mention should be made, too, of the work that has been done on the development of sulfurized soluble oils which offer extreme-pressure characteristics. Late reports indicate that cutting oils are being recommended for certain grinding jobs where superior surface quality is desired. We understand that combinations of the proper grades of grinding wheels with special oils have yielded remarkable results.

Transparency also is an essential characteristic on many types of machining operations. Many producers can supply transparent material wherever required. These are available in sulfurized and extreme-pressure blends; also in solubles which are available in two general types—those that form a milky-white emulsion, and those which form translucent to transparent emulsions depending upon the strength of the mixture.

When it comes to the actual selection of cutting fluids for any given job, there are many factors that must be taken into consideration. Among these are the following:

1. Type of operation.
2. Mechanical condition of the machine.
3. The work itself — character of metal, desired finish, dimensional accuracy.

"SERVICE PROVED"
CUTTING OILS RANK HIGH
IN THREAD CUTTING OPERATIONS

To a large Screw and Bolt company of Gary, Indiana—capable of turning out more than a million different sized bolts a day—speed, accuracy and tool life in their threading operations are exceedingly important. Their report to us that Cities Service Cutting Oils have proved "very satisfactory" again confirms the experiences of many others who depend on these Service Proved oils for exacting requirements.

It will pay you, too, to get acquainted with these Service Proved oils and our Lubrication Engineers' Service. Let us tell you more about them. Just fill in the coupon below and mail it. An interesting booklet entitled "Metal Cutting Lubrication—In Theory and Practice" also will be sent you, if you are interested.

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Business Address.....
Firm Name.....
City..... State.....

4. Speeds and feeds.
5. Nature of the cut—rough, semi-finish, finish.

However, a discussion of the selection of cutting fluids is a very technical matter. Consider, for example, the matter of machinability. The Independent Research Committee has made a number of studies of this phase of the situation covering both ferrous and non-ferrous metals, and is preparing a new study in which both types of materials have been combined in a single table in an effort to produce a generalized picture of the relative ease of machining, coupling the machinability rating with recommended cutting fluids. Obviously, space does not permit more than passing reference to this work.

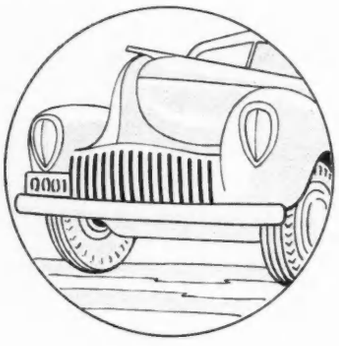
Recent surveys of actual practice in metal cutting plants indicate that there is very little of what may be called standardization of cutting fluids. It is worthy of note, however, that there is a definite tendency to a simplification, i.e., a reduction in the variety of cutting fluids in general use. It is safe to say that as metal cutting establishments, in general, begin to take advantage of the special knowledge available in this field, they will approach an ideal degree of simplification, marking a sharp advance in overall economy.

We are impressed by the fact that in the selection of cutting fluids the overall result is far more important than is the emphasis upon chemical specifications. Specifications may be of some value as a guide but the chemists and metallurgists know how difficult it is to buy any kind of petroleum products on specifications alone. It is the consensus that the best results are achieved by purchasing cutting fluids from reliable suppliers, using the types and grades of materials that prove to be most suitable in actual production testing.

Finally, it is of utmost importance to stress the twin requisites of antiseptic quality of the cutting fluid and physical cleanliness of all solutions. Control of both functions by suitable filtering and treatment with antiseptic additives, if need be, constitutes the simplest and most economical means of avoiding and eliminating occupational hazards.

Our object here has been primarily to touch on some of the high spots of the cutting fluid problem rather than to cover the subject comprehensively in all of its ramifications. If management will view the situation seriously, if management will set up a suitable means of control by delegating the responsibility to a chemist or metallurgist or someone in the master mechanic's department, the whole problem will be well in hand.

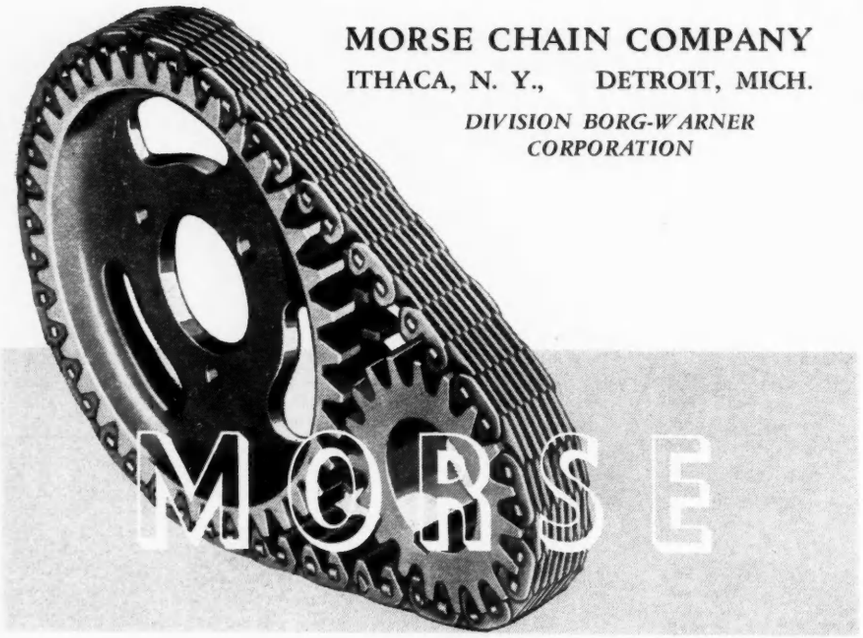
As the appended material indicates, the field of cutting fluids is highly competitive, comprising as it does the products of many of the largest petroleum producers in this country, including also many outstanding producers of specialty products. Competent repre-



1940

While countless thousands of new Morse-equipped cars go over the 1940 production lines, Morse's increasing engineering research is creating, in its product, improvements that again merit its association with the industry's finest cars.

MORSE CHAIN COMPANY
ITHACA, N. Y., DETROIT, MICH.
DIVISION BORG-WARNER CORPORATION



Literature on Cutting Fluids

American Society of Mechanical Engineers—Bibliography on the Cutting of Metals (1930)

Automotive Industries—file, index.

O. W. Boston, director, department of metal processing, University of Michigan—Fundamental studies metal cutting, transactions ASME, ASM.

Cincinnati Milling Machine Co., Hans Ernst—Physics of Metal Cutting.

Cities Service Oil Co.—Metal Cutting Theory and Practice.

The Esso Marketers—Cutting Fluids.

E. F. Houghton & Co.—Cutting Fluids, also bulletin Cut-Max oils and bases.

Independent Research Committee on Cutting Fluids.

The International Nickel Co. — Technical bulletins on machining of nickel steels.

National Metal Handbook—Sections on metal cutting and machinability.

Shell Oil Co.—Technical bulletins on metal cutting.

Standard Oil Co. of Indiana—Technical bulletins, recommendation charts.

D. A. Stuart Oil Co.—The Story of Sulfurized Cutting Oils.

Socony-Vacuum Oil Co. — Socony-Vacuum Machinability Index and Recommendations.

The Texas Co.—Lubrication, November and December, 1936; also recommendation charts.

Suppliers of Cutting Fluids

Acheson Colloids Corporation, Port Huron, Mich.
Acme Refining Co., W. 56th St. & W. & L. E. Ry., Cleveland, Ohio.
American Oil & Grease Corp., 201 N. Wells St., Chicago, Ill.
Atlantic Refining Co., 260 S. Broad St., Philadelphia, Pa.
Atlas Chemical Co., 402 Peoples Bank Bldg., Marietta, Ohio.
Bayerson Oil Works, E. 12th St. & P. R. R., Erie, Pa.
Burns Laboratories, 514 W. Wyoming St., Indianapolis, Ind.
Cities Service Oil Co., 60 Wall Tower, New York, N. Y.
Climax Refining Co., 2890 E. 83rd St., Cleveland, Ohio.
Delta Oil Products Co., Teurtonia & Mill Rd., Milwaukee, Wis.
E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa.
J. W. Kelley Co., 13209 Athens Ave., Cleveland, Ohio
Middle States Oil Co., B. of L. E. Bldg., Cleveland, Ohio.
Oakite Products, Inc., 22 Thames St., New York, N. Y.
Panhard Oil Corp., 17 Water St., New York, N. Y.
Pure Oil Company, 35 E. Wacker Drive, Chicago, Ill.
Shell Petroleum Co., Shell Bldg., St. Louis, Mo.
Sinclair Refining Co., 630 Fifth Ave., New York, N. Y.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Socony Vacuum Oil Co., 26 Broadway, New York, N. Y.
Standard Oil Co. of Indiana, Chicago, Ill.
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.
Stuart Oil Co., D. A., 2727 S. Troy St., Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
The Texas Co., 135 E. 42nd Street, New York, N. Y.
Universal Oil Co., 88 Lexington Ave., New York, N. Y.
Wayne Chemical Products Co., Copeland Ave. & M. C. R. R., Detroit, Mich.
White & Bagley Co., 100 Foster St., Worcester, Mass.

sentatives of any machine shop can get the best results by drawing upon the experience and recommendations of these specialists.

Ford Lines Are Restyled

(Continued from page 439)

in convertibles. Custom interiors also are available, with two-tone upholstery treatment. In these the seat cushions and backs are in dark shades, while the headlining, side-walls and doors are in harmonizing lighter shades.

In the new Continental cabriolet the hood is 7 in. longer and 3 in. lower than in other body styles, which changes the styling materially. Each seat accommodates three people. In the club coupe there is a full-width seat behind the divided front seat, while in the coupe two opera seats may be factory-installed (at extra cost) in place of the luggage space and shelf back of the seat.

Britain to Study Coal Gas Engines

The London, England, correspondent of the *Montreal Daily Herald* in his recent weekly London business letter says:

British Members of Parliament are shortly to be shown new types of motor car engines driven by high-compression coal gas which, it is claimed, operate as efficiently as engines driven by either oil or petrol. The engines were developed at the National Gas and Oil Engine Company's works at Ashton-under-Lyne, England.

The importance of the development during time of war, when supplies of imported fuel may be precarious, is realized by the British Government, where a keen interest in the new engine is being shown.

Already the United Kingdom Gas Corp. is investigating the possibility of setting up gas-filling stations in various parts of the country. These will refuel gas-driven lorries and gas-driven motor vehicles from cylinders containing compressed gas or from gas compressors on precisely the same principle as that used in putting air into tires. The whole operation is said to take only a few seconds.

dag
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COLLOIDAL GRAPHITE
SURVIVES FIRE . . .
. . . without losing its lubricating properties even at temperatures of 1800°F and upwards in ceramic and glass making machines; in conveyors and baking ovens, in die casting and permanent mold equipment.
"Dag" outlasts temperatures that burn petroleum oil, thus lubricants can be prepared by dispersing this product in fluids that quickly evaporate at the higher temperatures. Only a positive, clean lubricating film of pure "dag" colloidal graphite is left which becomes affixed to the bearing surfaces. "Dag" makes an ideal teammate for oil, as it takes over the load at the point beyond which plain lubricants fail.
A note on your letterhead will bring a production sample and Technical Bulletin 130 which tells how to use "dag" for high temperatures . . . you or your oil supplier can easily add "dag" to your present lube or to specially selected petroleum fluids.
ACHESON COLLOIDS CORPORATION
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COLLOIDAL PRODUCTS

Automobile Old Timers Plan "Get-Together" in New York

About 200 Who Were Identified with Automobiling 25 Years Ago Will Meet for Luncheon on Oct. 18

More than 200 quarter-centenarians of the automobile world will meet for luncheon Oct. 18 in the Hotel Lexington, New York, to commemorate the first automobile show in Madison Square Garden and other high spots of automotive history.

Hon. Dave Hennen Morris, one-time ambassador to Belgium and the fourth president of the Automobile Club of America, is honorary chairman of the luncheon committee. Judge William H. Hotchkiss, first president of the American Automobile Association, will be toastmaster.

The old timers will present a program recalling the tribulations of early motoring, the Vanderbilt Cup races, the Glidden tours, and other events which were big news at the dawn of the horseless age.

This will be the first large get-together of pioneer motorists and automobile manufacturers ever held. The first "stop and go" semaphore ever used by any city will be used to govern the length of the speeches. The device was put in use on Fifth Avenue, New York, in 1915.

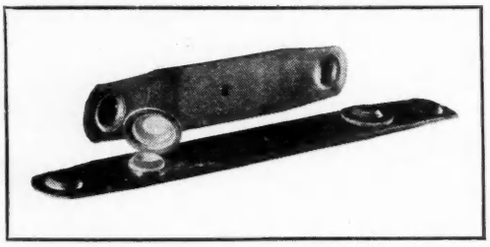
Major August Post, who bought the first car offered for sale in the 1898 bicycle show in Madison Square Garden, a pioneer in balloon racing, and manager of four of the Glidden tours, is treasurer of the luncheon committee, and Frederick H. Elliott, an early secretary of the A.A.A., is secretary and will be in charge of arrangements.

Serving under Chairman Hotchkiss will be Captain E. V. Rickenbacker; David Beecroft, Bendix Aviation Corp., treasurer of the Society of Automotive Engineers and one-time directing editor of AUTOMOTIVE INDUSTRIES; William L. Colt and Clifford M. Bishop, veteran automobile dealers, and Chris Sinsabaugh, veteran automobile editor, serving as vice-chairman.

Following the lunch, the old timers will be guests of the Automobile Show. The day has been designated as Old Timers' and Engineers' Day at the show.

A coast-to-coast broadcast of a part of the proceedings will be handled by NBC, Major Post announced.

NEOPRENE
HELPS SOLVE
PACKARD SPRING PROBLEM



Neoprene closure crimped to metal cap makes perfect seal.

PACKARD engineers attacked the important problem of squeaks and friction in springs by using antimony-lead inserts between the lower spring leaves.

But that remedy brought on another problem. Antimony-lead alloy oxidizes quickly. So, in order to prevent oxidation, they devised a protective covering of grease, with a metal cap to keep the grease in position.

But here, again, a third and final problem arose. What resilient material would seal this metal cap permanently, regardless of exposure to grease?

The answer was Du Pont *neoprene*. A neoprene closure crimped to the metal cap made a perfect seal, and Packard engineers successfully concluded their search for effective squeak control.

Neoprene has the strength, resiliency and toughness of rubber—but it is far more resistant to petroleum distillates and to aging. For helpful, current information about this remarkable material, write for your free subscription to the newsy monthly Neoprene Notebook. Address your request to E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division, Wilmington, Delaware.

DU PONT
REG. U.S. PAT. OFF.

NEOPRENE
CHLOROPRENE RUBBER MADE BY DU PONT

Metal Show and Metal Congress

(Continued from page 422)

applications of resistance welding.

The Wire Association program contains a paper on "The Elasticity of Spring Wire" by George Nelson, L. A. Young Spring and Wire Corp., one on the "Brazing of Copper" by L. L. Wyman, General Electric Co., one on the "Atmospheric Annealing of Steel Wire" by Allan Bates of the Westinghouse Electric and Mfg. Co. and one on the "Manufacture and Use of Stainless Steel Wire" by Stanley P. Watkins of the Rustless Iron and Steel Corp.

The technical programs of all the participating societies, as well as the National Metal Show are sprinkled with films showing new developments in metallurgy, processing, and construction.

Modern Proving Track for IHC

A new 1½-mile proving track consisting of an oval-shaped concrete pavement, various types of hazardous highway sections and other ground tests, is being constructed by International Harvester at its Fort Wayne truck works, at a cost of $75,000. Completion of the test grounds is scheduled for Nov. 15.

L. F. Shoemaker

. . . Newly appointed sales manager of the automotive and industrial division of the Buda Company, Harvey, Ill.

Prices for 1940 Ford, Mercury, Lincoln-Zephyr

The Ford Motor Co. has announced prices for 1940 Ford V-8, Mercury, and Lincoln-Zephyr passenger cars as follows (distribution and delivery charges, also all Federal, State and other taxes, extra):

Ford

60 Horsepower Engine	
Tudor sedan	$640
Fordor sedan	685
Coupe	600
Business coupe	620
85 Horsepower Engine	
Tudor sedan	680
Fordor sedan	725
Coupe	640
Business coupe	660
Station wagon	850
DeLuxe tudor	740
DeLuxe fordor	785
DeLuxe coupe	700
DeLuxe business coupe	720
DeLuxe convertible club coupe	825
DeLuxe station wagon	920

Mercury

Sedan (2-door)	$920
Town sedan (4-door)	960
Sedan coupe	960
Club convertible	1,050
Convertible sedan	1,180

Lincoln-Zephyr

Three-passenger coupe	$1,360
Sedan	1,400
Club coupe	1,400
Convertible coupe	1,770
Town-limousine	1,740
Continental cabriolet	2,340

Watch Out, Mr. Cobb!

Augie Duesenberg, Indianapolis pleasure and racing automobile inventor and builder, is said to be planning a new racing car which he hopes will exceed a speed of 400 m.p.h.

Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1939	1938	1939	1938	1939	1938
January	291,444	168,890	62,502	58,062	353,946	226,952
February	250,897	151,133	61,244	51,464	312,141	202,597
March	312,392	186,341	77,097	52,106	389,489	238,447
April	286,200	190,111	68,063	47,818	354,263	237,929
May	249,455	168,599	63,759	41,575	313,214	210,174
June	257,289	147,545	66,946	41,857	324,235	189,402
July	155,850	112,114	62,628	38,336	218,478	150,294
August	62,452	61,687	40,891	35,259	103,343	96,946
September	.....	69,449	.....	20,174	.....	89,623
October	.....	192,906	.....	22,380	.....	215,296
November	.....	335,767	.....	54,638	.....	390,405
December	.....	341,524	.....	65,492	.....	406,960
Total	.....	2,126,066	.....	529,161	.....	2,655,171

Looking forward TO BACK SEAT CONVENIENCE

There's no more useful gadget in the modern automobile than the glove compartment. But why confine this convenience to the dashboard? Why not provide back seat passengers with a place to park small duffle? Especially when such a cache can be made so attractive with a door of Durez plastic!

Designs like this are easy (and inexpensive!) to execute in Durez. Usually they can be molded and finished in one operation. And they are extremely effective. Durez gives them color and sparkle . . . a smooth surface that never chips or peels because it's solid clear through . . . strength to withstand hardest wear and tear.

Tell your engineers about this practical idea—and let us tell *you* about many others that can be worked out to your advantage in Durez. Write Durez Plastics & Chemicals, Inc., 910E Walck Rd., North Tonawanda, N. Y.

DUREZ PLASTICS & CHEMICALS, INC.

Plastics That Fit The Job

Here's a **PROFITABLE ANSWER** *to More and More Fabricating Problems*

EXAMINE YOUR own products. Perhaps there are several places where you can improve them at worthwhile savings by fabricating them from American Quality Cold Rolled Strip Steel.

AMERICAN Quality Cold Rolled Strip Steel is getting the call wherever the requirements demand a metal that offers attractive finish, uniformity, ductility and LOW COST. Investigation will prove to you that this product can be relied upon to make serviceable, dependable parts that are light in weight, have a smooth, shining finish, and are completely accurate in size.

The complete range of widths, finishes, edges and tempers available in American Quality Cold Rolled Strip Steel provides unlimited possibilities for the improvement of numerous items at reduced costs. This product is easily adapted to high speed continuous operations and is doing an outstanding job in many places where more expensive metals were formerly used.

Our facilities for producing American Quality Cold Rolled Strip Steel have been expanded to meet the increasing demands of industry for this product in its many forms. We have assisted many manufacturers in planning the most economical application of Cold Rolled Strip Steel in their operations and our representatives gladly offer this service to you.

AMERICAN *Quality* COLD ROLLED STRIP STEEL

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL